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ABSTRACT

The report describes ASSIST, a teacher-controlled computer assisted instruction (CAI) system in special education. Field tested with aproximately 200 handicapped elementary and junior high students (educable mentally retarded, educationally handicapped, learning disabled, and oral language handicapped). Results are said to demonstrate that such a system can operate reliably and successfully in special education classrooms, as evidenced by ease of incorporating CAI with classroom activities, large number of lessons created by the teachers, extensive student use of the system, and positive responses from teachers and students regarding the system. Recommendations are made for continued development of ASSIST. Two appendixes contain sample ASSIST author sheets and evaluation questionnaires. (CL)

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INTRODUCTION

Computer-assisted instruction (CAI) theoretically holds substantial promise for the field of special education. Much of what is known about the learning characteristics of mentally handicapped children indicates that CAI should be an extremely useful tool in their instruction. Their needs for systematic presentation of small increments of curriculum material, for immediate feedback and positive reinforcement, for repetition and 'overlearning', and for individualized programs of study make CAI a particularly suitable teaching device for handicapped children. This project investigates the potential use of CAI for special education, by developing a CAI system suitable for special education students and by documenting its usefulness and evaluating its effectiveness through an operational demonstration of the system in special education classrooms.

The usefulness of a CAI system largely depends on the appropriateness of the curricula materials it presents for the student population it serves. After surveying CAI 'courseware', it was concluded that existing materials did not accommodate the needs of special education students, mainly because their contents were too difficult, the step size too large, the pace too fast. It was thus necessary to develop materials more suitable for special education students. Because the needs of individual handicapped students are so varied, one set of CAI curricula materials with adaptive decision rules for placement and sequencing did not seem adequate for prescribing instruction. Based on the viewpoints that, for children with learning handicaps, teachers are the best judges of what their students need to learn and that CAI lesson materials should correspond to teachers' classroom activities, an approach in the development of this CAI system was taken whereby the system was designed to give teachers easy authoring capabilities and lesson assignment control as well as convenient management of student information. In this way, instead of imposing upon teachers a developed curriculum with defined sequences that may or may not correspond to teachers' classroom activities, the essential instructional functions of lesson creation and assignment would be under the teacher's control, so that teachers are able to supplement conveniently their classroom instruction with the computer instruction of their choice.

With this basic goal of developing a teacher-controlled CAI system that would serve teachers as a useful resource in their classrooms, the system designers visited many special education classrooms, observed the student-teacher interactions, the instructional procedures and techniques, the materials used, and discussed with teachers their needs, their requirements, and their recommendations for a CAI system. The results of these interactions was the formulation of the ideas of the ASSIST* CAI system. A central feature of ASSIST is that it provides teachers the

*Authoring System Supplementing Instruction Selected by Teachers.

means to easily create CAI lessons without having to do formal programming. In addition, ASSIST gives teachers several student management capabilities, including lesson assignment, student enrollment with special needs, obtaining reports of student progress, and sending messages to individual students.

A year was spent in developing ASSIST, and another year in demonstrating its use in the special education classrooms of Cupertino Union School District, California. The remainder of this paper describes the central ideas of ASSIST and its implementation in the demonstration program, as well as presents the evaluation results obtained from the demonstration year.

DESCRIPTION OF THE ASSIST SYSTEM

The Authoring System

The models approach. The purpose of the ASSIST authoring system is to simplify the creation of CAI lessons by allowing teachers to create lessons without having to do any formal programming. To accomplish this, the models approach was adopted.* The idea is to identify common elements in the structure of various lessons and from these to design models of lesson formats that can be used for presenting a variety of lesson materials. For each model, two computer programs are written: (1) an author program that prompts the teacher to enter the contents of a lesson according to the model's specifications and from which it creates a lesson file, and (2) a lesson program that presents lessons to the students from the data in the lesson files according to the model's design. Thus, many different CAI lessons can be created using a few author programs. To create a lesson, teachers need only select a model format, define the lesson contents, and enter this content guided by the prompts of the author program. Author sheets for each model enable teachers to plan their lessons on paper before entering the lessons into the computer (see Appendix A). In this way, a lesson can be created in about 15 mintes. Figure 1 illustrates the authoring process.

The ten ASSIST models. To provide a rich variety of formats for creating lessons, ten models have been designed and programmed. Other useful formats can easily be added to the system, if desired. Following is a brief description of the ten ASSIST models.

Binary is a question/answer model where the student must select between one of two defined values as the correct answer (e.g., yes/no, true/false, noun/pronoun, same/different).

Choice is a multiple choice question/answer model.

Copy is a perceptual drill model that requires students to copy, or recall and copy items that have been presented.

Drill is a simple arithmetic drill model that randomly generates problems in addition, subtraction, multiplication, and division within certain numerical ranges.

Match is an association exercise that requires the matching of items from one list with those on a corresponding list.

Narrative is a model that simply presents a story or text.

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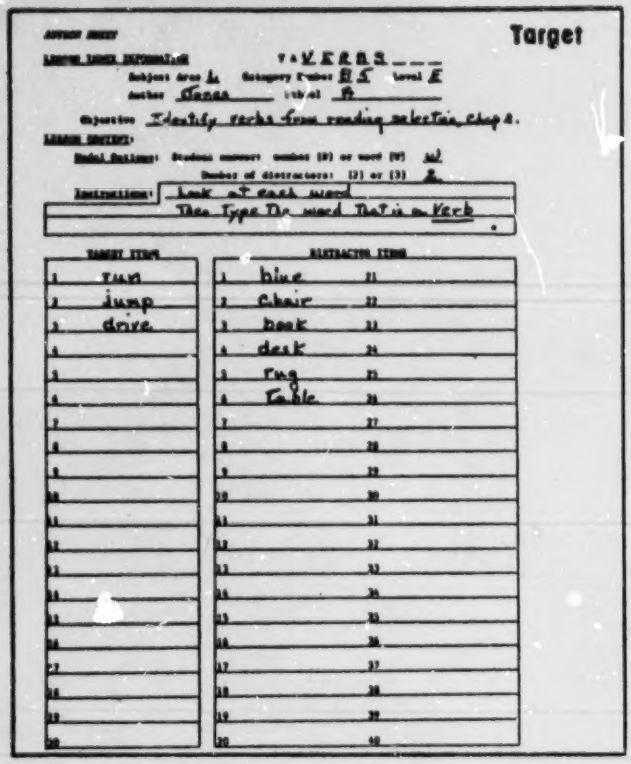
*The concept of the approach owes much to the CAI work done at Lawrence Hall of Science and the California School for the Deaf, Berkeley, California.



AUTHOR SHEET

Target

LESSON INDEX INFORMATION

TAVERBS

Subject Area 1 Category Number 85 Level E

Author Jones Initial A

Objective: Identify verbs from reading selection chap 4.

LESSON CONTENT:

Model Options: Student answer: number (N) or word (W) W

Number of distractors: (2) or (3) 3

Instructions: Look at each word.
Then Type the word That is a Verb

	TARGET ITEMS		DISTRACTOR ITEMS	
1	run	1	blue	11
2	jump	2	chair	12
3	drive	3	book	13
4		4	desk	14
5		5	rug	15
6		6	Table	16
7		7		17
8		8		18
9		9		19
10		10		20
11		11		21
12		12		22
13		13		23
14		14		24
15		15		25
16		16		26
17		17		27
18		18		28
19		19		29
20		20		30

Defining Lesson Contents Using Assist Author Sheet

```
Which PROGRAM do you want (? for help: or BYE to log out)? @   author

This is AUTHOR...

Create: Delete: Examine: or Modify a Lesson: or List an Index! @  create

MODEL name or prefix! @  target

AUTHOR's name (10 letters at most)! @  Jones

The temporary name for this lesson is TAJONE2276
New temporary file TAJONE2276   has been created.

Enter information from your Target Author Sheet.
Enter Target model options
   Student answer (N or W)!    @  w
   Number of distractor items (2 or 3)    @  3

Enter instructions (@ to end)!
 @  Look at each word.  Then type the word that is a VERB.\
Instructions can't(@ to end)
 @  !!!!
```

Position requires students to select the number associated with a word or space in a sentence that correctly answers the question.

Question is a question/answer model that requires a key word answer.

Spell requires the verification of a correctly spelled word or if mispelled, the entry of the word spelled correctly.

Target requires the identification of an item belonging to a particular category from several items that do not belong.

Lesson-interaction options. Seven lesson-interaction options have been included in all ASSIST model programs to give additional flexibility in the lesson design. These options are (a) random or sequential presentation order, (b) length of time out, (c) correct answer reinforcers, (d) use of stars as reinforcers, (e) and (f) wrong answer responses on the first and subsequent tries, and (g) wrong answer hints. The author/teacher may simply accept standard options as programmed or may enter individual choices for these options through the queries of the author programs.

Lesson indexing. All lessons available through the ASSIST system can be stored in the system's public library and are catalogued in a subject area directory and a model directory. From these indexes, teachers can easily select lessons to assign to their students. As a lesson is created, it is entered into the lesson indexes and initially is stored in the user's private library, but may be moved to the system's public library and become available to all users. In this way, the library of ASSIST lessons is constantly increasing.

In addition to creating lessons, teachers may also examine, modify, and delete existing lessons, and list indexes by subject area or model.

Student Management Facilities

In order to take a lesson on the ASSIST system, students must first be enrolled. Teachers control the enrollment of their students, through an enrollment program (PUPIL). To further individualize lessons for each student, at enrollment time teachers may specify six special needs that determine the forms and procedures for presenting lessons for each student. These special needs include (a) upper-case presentation only, (b) extra vertical spacing between lines, (c) display of log-on messages, (d) review of incorrect items, (e) presentation of student scores, and (f) obtaining student opinion of lessons. The purpose of this feature is to allow teachers to adapt lessons to students' needs without having to create additional lessons for each student.

Teachers may pre-assign lessons to individual students or request a specific lesson for a student at sign-on time. This dual lesson selection procedure allows teachers to pre-plan individual students' lesson

assignments as well as make alternate lesson selections according to the student's most recent activities.

Reports of student progress provide timely information on students' performance and indicate students' mastery of concepts or areas in need of remediation. Teachers (via the REPORT program) can request information about particular students or about an entire class for any specified time period. In this way, teachers can easily monitor students' progress.

Lastly, teachers may send messages to individual students through the PENPAL program. Figure 2 summarizes the ASSIST programs available to teachers for the above described functions. A more detailed description of the ASSIST system can be found in the ASSIST System Documentation.

The Student Taking a Lesson

The ASSIST models lend themselves to drill and practice lessons, which supplement a teacher's classroom instruction. By and large, these lesson presentation procedures follow the standard CAI protocol of item presentation, response evaluation, and feedback. Within the constraints of these simple lesson-presentation procedures, several student options and more personalized presentation features have been added.

When a student completes a lesson, the student's performance on the lesson is recorded on his/her history. A separate history file is kept for every enrolled student and is used for student reports. After the lesson information is recorded, the system returns to the 'wait' state, ready for the next student to sign on.

Students may also send messages via their terminals to assigned penpals, teachers, or other students. This communication capability provides a communication link among students and is intended to give students further motivation for using the system.

A theoretical advantage of CAI is that instruction can occur on a one-to-one basis between the student and the instructional system. This, however, demands more wisdom and ability than CAI designers have yet acquired. In some system-controlled CAI systems, the system individualizes instruction by selecting appropriate lessons for students by algorithmically estimated student needs and lesson hierarchies. In the ASSIST system, the judgment of individual students' needs and selection of appropriate lessons are external to the system and are under teacher control. The ASSIST system aids teachers in individualizing instruction by providing teachers with easy means of lesson creation and assignment and with reports of student progress. The system does not pretend to understand the students' thinking or his/her needs and does not prescribe instruction for students.

The Hardware Configuration

The computer used for implementing ASSIST was a standard mini-computer time-sharing system, the BTI-4000, produced by Basic Timesharing

FLOW OF CAI-SYSTEM PROGRAMS THAT ARE UNDER DAILY TEACHER CONTROL

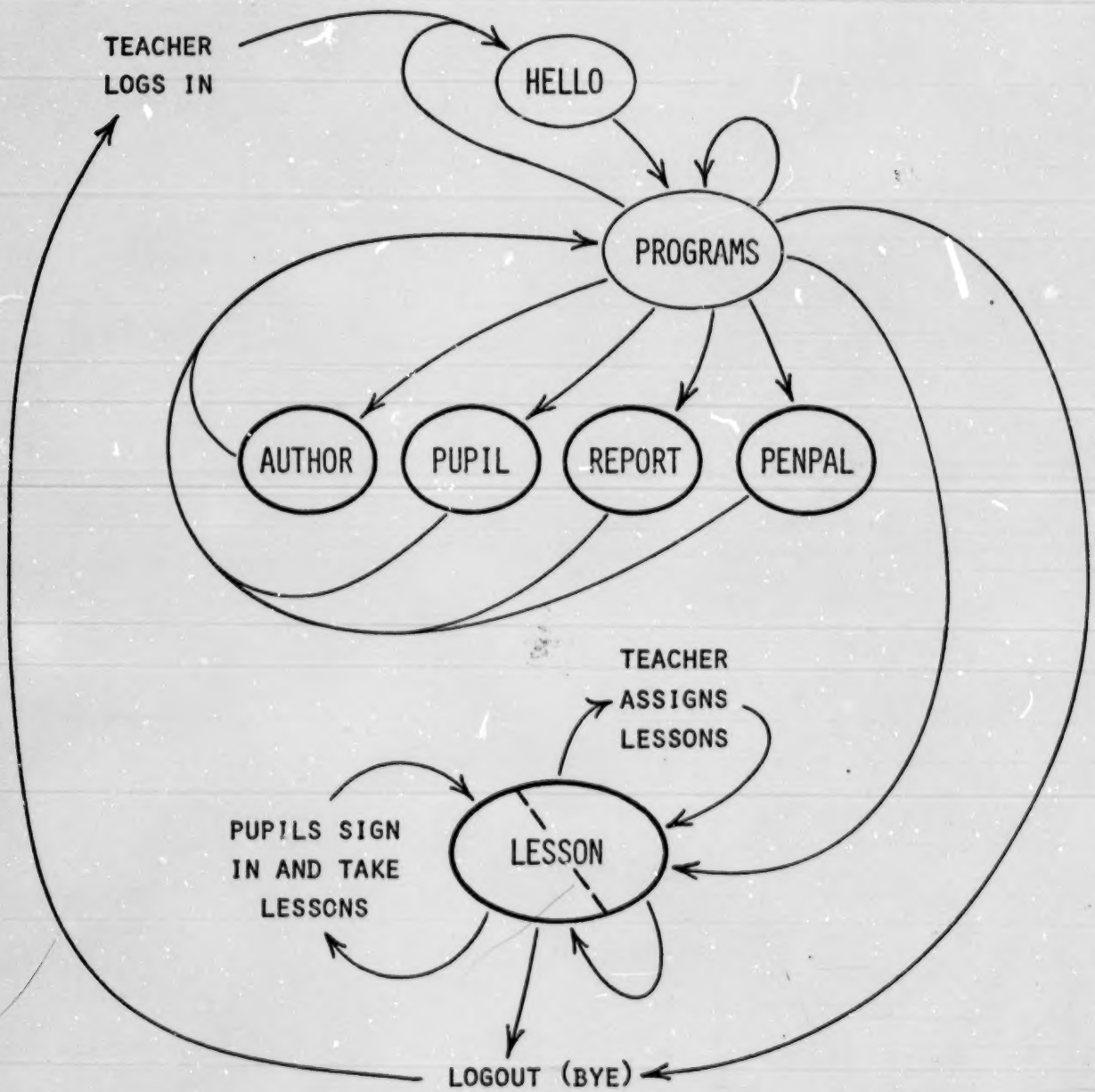


Figure 2. ASSIST Programs

Incorporated. It is a 16-bit (2 byte) word machine with 32 kilowords of fast memory. The configuration chosen was a 16-port (16 terminal) system with 20 megabytes (20 million characters) of disk storage. All programs were written in the Basic programming language. The terminals used were Decwriters, 30-character per second teletypewriter terminals produced by Digital Equipment Corporation. Modems (telephone line multiplexors) produced by Prentice Electronics were used along with four-wire telephone lines to provide the telecommunications. All equipment chosen proved to be extremely reliable. Down time for the computer totaled 16 hours, or approximately .002% of total run time. Down time for terminals averaged approximately 4 hours per terminal throughout the 35 weeks of the project's operation.

DESCRIPTION OF THE DEMONSTRATION PROJECT

In order to demonstrate the use of ASSIST, the system was installed in special education learning centers in the Cupertino Union School District (CUSD), California, and was operational for the 1977-1978 school year. The purpose of the demonstration was to show that CAI can operate reliably and effectively in a special education environment and to evaluate the usefulness of this teacher-controlled CAI system as well as its cognitive impact on children with learning handicaps.

Demographics of the Demonstration Sample

Cupertino School District is one of northern California's largest elementary school districts, serving nearly 20,000 students in 30 elementary schools, 6 junior high schools, and one school for the mentally retarded. Because of the location in the midst of the San Francisco Bay area's aerospace, electronics, and research industries, most of the students served come from middle-income families.

Each school in the district has a learning center that serves children with exceptional needs. Approximately 10% of the students are diagnosed as educationally handicapped and are assigned to the learning centers for supplementary education. Children come to a center for special help according to each child's individual educational prescription; emphasis is placed on 'mainstreaming' or placing children in the least restrictive environment. Children with more severe handicapping conditions are assigned to self-contained centers or special schools. The district's careful procedures for identifying handicapped students, their approach towards individualizing instruction for these students through the individual educational plans (IEP), and the existence of established learning centers made CUSD an ideal district for housing the CAI demonstration project.

The support and cooperation of the district at all levels were crucial to the success of this demonstration. Therefore, steps were taken to explain the project to the district administators, the special education coordinators, the principals, and most importantly the teachers: From a list of suggested candidate schools, eight schools (four elementary and four junior high) were selected for participation based on the distribution of types of handicapped students in the school, on the ages of these children, and on the willingness of the teachers to participate.

Four types of handicapped students were served by the demonstration project. These groups are (1) the educable mentally retarded (EMR), (2) the educationally handicapped minors (EHM), (3) the learning disability group (LDG), and (4) the severe oral language handicapped (SOLH). An EMR child, usually with an IQ in the range from 50 to 80, because of subnormal mental development, is unable to profit sufficiently from the regular school program but is considered to be educable in the academic subjects

at a minimal level. The educationally handicapped minors have normal intelligence but have learning handicaps associated with behavioral disorders or neurological handicaps. The learning disability group consists of children who manifest serious difficulties in learning and communicating for a variety of reasons not directly related to sensory impairment, mental retardation, or emotional disturbance. The SOLH chldren are similar to the LDG children but with more severe oral communication problems. These four handicapped groups were selected first because they represent the largest group of handicapped children; second because they are not physically impaired, thus do not require special terminal equipment; and last because common instructional strategies could be used for their treatment, i.e., positive reinforcement, repetition, immediate feedback, small increments of curriculum material and short sessions.

Approximately 200 students participated in the project. About half the students belonged to the LDG group and the remaining half were almost equally divided into the other three groups. The EMR students were in two self-contained special education classrooms; one, the top functioning group in an elementary school for mentally retarded students and the other, students in a separate learning center of a regular junior high school. The ages of the students ranged between 7 and 16, with the average elementary school student being 10 and the average junior high school student 13. No student had exposure to CAI prior to their participation in this project.

Operations of the CAI Program in the Learning Centers

The learning centers were spacious, well equipped resource centers, with well defined subject matter location where students were scheduled individually or in small groups for instruction according to each student's individual education plan. The number of students and the amount of time each spent in the centers varied. Each center was supervised by one to three teachers and by one to three aides, with the ratio of teacher and aides to students being generally about 1:8. The activities and atmosphere in each center was defined by the learning center's teacher(s), and varied from a quiet, structured, and disciplined environment to one of more movement, noise, and apparent activity.

Depending on the size of the student population in a center, one to three computer terminals were installed in each of the eight centers. In the two schools where there were three terminals, these terminals were placed in a small, separate room adjacent to the learning center. In general, the terminals were well integrated into the learning center environment, and were not disruptive of other ongoing activities.

Since the goal of the CAI project was to develop a teacher-controlled system that would serve teachers as a supplemental resource to their other classroom instruction, the scheduling and operation of the system was left

to the teacher's judgment. In some centers, students were scheduled for regular use of the system; in others, scheduling was less structured and assignment to system use remained flexible. Selection and assignment of lessons for the students were determined by the teachers, but in some cases, teacher aides supervised the mechanics of the system's use. Although no requirements for the system's use were place on the teachers, it was suggested that students spend about ten minutes a day on the system. Teachers were guided in the application of the system to their classroom instruction but the actual use of the system was left to each teacher's instructional objectives.

Fundamental to the operation of the ASSIST system is the premise that a public library of teacher-created lessons will be developed during the course of its use and that teachers can share in the use of these lessons. To implement the sharing, a directory of ASSIST lessons was constantly updated as new lessons were created and was available to teachers in its entirety or in a partial listing of the most recently created lessons. To further facilitate this sharing process, descriptions and samples of new lessons were distributed to the teachers monthly. By establishing this network for sharing lessons, it was anticipated that the need for teachers to create new lessons would diminish.

Teacher Involvement and Training

The success of the ASSIST system depended on the teachers' understanding of the instructional functions of the system, their perception of its usefulness, their ability to easily manipulate it and their willingness to use it. Therefore, efforts were made to involve teachers in the development of the system and to train them to understand its applications and its mechanics.

The 14 participating teachers and 8 teacher aides had no previous exposure to using computers in the classroom. Prior to their commitment of participation, a field trip was arranged to the California School for the Deaf in Berkeley, where a similar CAI program was in operation in in conjunction with Lawrence Hall of Science. This observation provided a glimpse of what perhaps the teachers and their students could hope to gain from the CAI project. Since teacher participation in the project was voluntary, the motivating factor in their decision to participate was whether they felt their students could benefit from its use.

During the development year, project staff members made frequent visits to the learning centers, observing the teaching techniques, procedures, and materials used in the center. Discussions with teachers concerning useful lessons and strategies contributed toward the final design of the ASSIST models and system capabilities. Through this communication, the system was developed that was sensitive to teachers' needs and the teachers were made to feel a vital contributing part of the project.

At the beginning of the second year--the operational year of the project--four two-hour workshops were conducted to train teachers in the use of ASSIST. For these workshops, a detailed Teacher's Guide to the use of ASSIST was prepared that contained all the necessary information for using the system. The first workshop was an orientation to the system, covering project goals and expectations, and procedures for using the equipment and enrolling students. The second workshop focused on the authoring system: how to create lessons using the various models, the use of author sheets and author programs; the remainder of the time was spent discussing ideas for lessons. The third workshop addressed the use of the ASSIST lesson directories, the assignment of lessons to students, procedures for taking a lesson, and scheduling of students for system use. The fourth workshop covered the uses of the REPORT and PENPAL programs, and served as a review of teacher-suggested items. At all workshops, 'hands-on' experience to practice topics covered during the session was made available to the teachers. A follow-up workshop was conducted four months into the program, to bring teachers up to date on the latest modification of the system and to discuss their problems and share their suggestions. Teacher questionnaires evaluating the effectiveness and usefulness of the workshop training indicated that about 90% thought the topics covered were very effective and useful and about 10% thought topics were fairly effective and useful.

In addition to the formal in-service training, individual assistance to teachers was provided through weekly site visits. The project staff members were readily accessible to teachers by telephone and the PENPAL program, which allowed teachers to send and receive messages. As the year progressed, the need for assistance was visibly diminished and telephone calls were less frequent, site visits were reduced to one in three weeks. The nature of the assistance changed as teachers took control of the system. Whereas initially the assistance was directed towards technical and mechanical questions, the emphasis of the assistance changed to ideas for lessons and coordinating lesson development among teachers. Through the workshops and the many contacts with the teachers, teachers made valuable suggestions for the refinement of the system.

In summary, the nature of this project demanded awareness, support, knowledge, and understanding on the part of the teachers in order that the system be properly implemented and used. Therefore, a great deal of effort was directed toward teacher involvement and teacher training.

EVALUATION

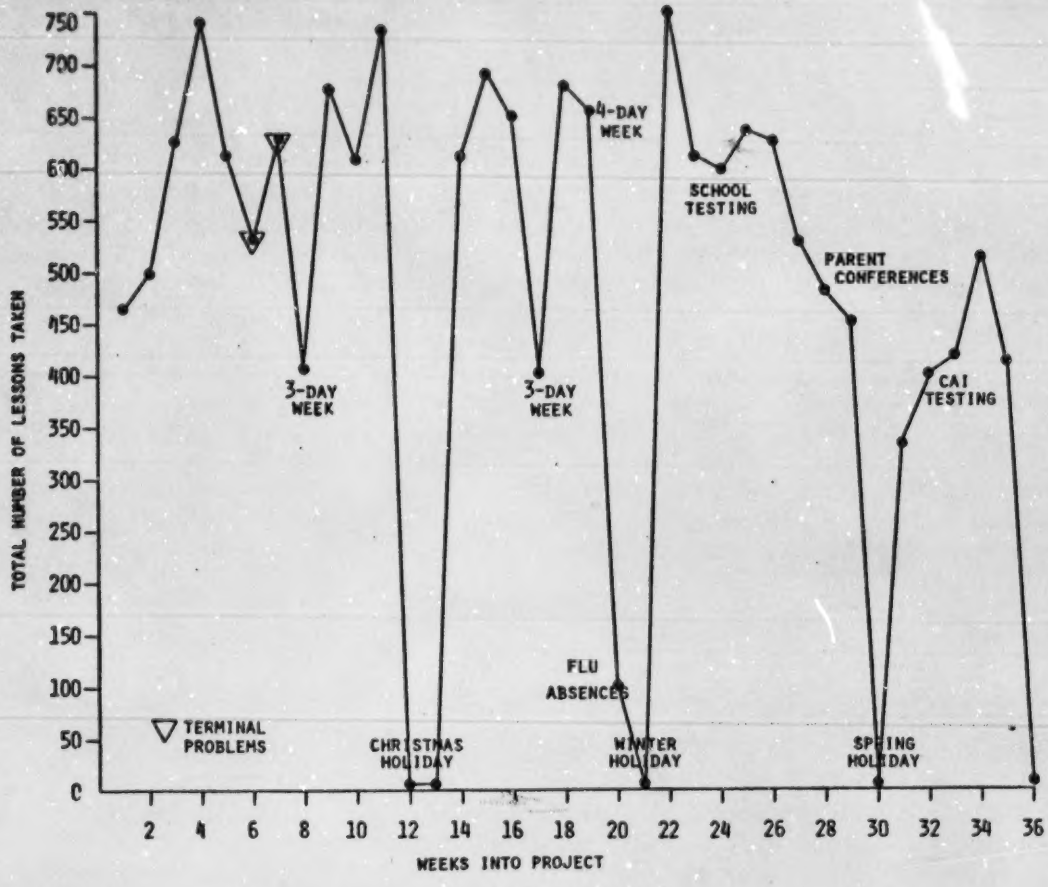
The demonstration that a CAI system is reliable and useful represents an accomplishment in its own right. However, educational evaluation practices require more quantitative evidence of the effectiveness of an innovative project. To this end, three types of data have been collected to evaluate the effectiveness of this project. First, to assess the utility of the ASSIST system in special education classrooms, the system recorded moment-to-moment information on the system's use, which included school usage, lesson usage, lesson creation, and student performance. Second, to assess the cognitive impact of the CAI program on handicapped children, pre- and post-achievement tests were administered to CAI treatment group students and their matched control group students to compare achievement gains. Third, a series of questionnaires was administered to teachers, students, and principals to assess their opinions of the system.

System Usage

Programs were written so the system could track how it was used by students and teachers. At the completion of every student lesson, three files were updated. The School Use file documented the location at which the lesson was taken, its date and duration. The Lesson Usage files recorded the frequency of each lesson's total use and its use by each school. The Student History files collected information on each student's performance, time-on, and opinion of the lesson for every lesson taken. From these files, the extent of system and lesson usage could be determined. Furthermore, the development of ASSIST lessons was documented by the model and subject indexes, which were updated immediately upon a lesson's creation and included information such as the author, date of creation, model used, subject and category of lesson, and objective.

Student usage of the system. Figure 3 presents the total time on the system and the number of lessons taken by all students for each week of the project's duration, with explanations for weeks of decreased use. This figure shows that after start-up, the system was used at a consistent rate of about 4,500 minutes and 650 lessons per week. Usage was surprisingly high after school holidays, indicating that use of the system was well integrated into school programs and not forsaken after holidays. Drops in system usage were caused mainly by events that disrupted the regular school schedule, for example, testing or parent conferencing.

Table 1 presents the total and average system usage by student and by schools for the 20 or so full weeks of program operation. On the average, each student took 5.3 lessons and 33 minutes of instruction per week on the system. These numbers do not include time spent on games or in signing on and selecting lessons. The amount of usage varied among the schools, with the minimum being 2.75 lessons and 17 minutes per week and the maximum being 11.6 lessons and 96 minutes per week.



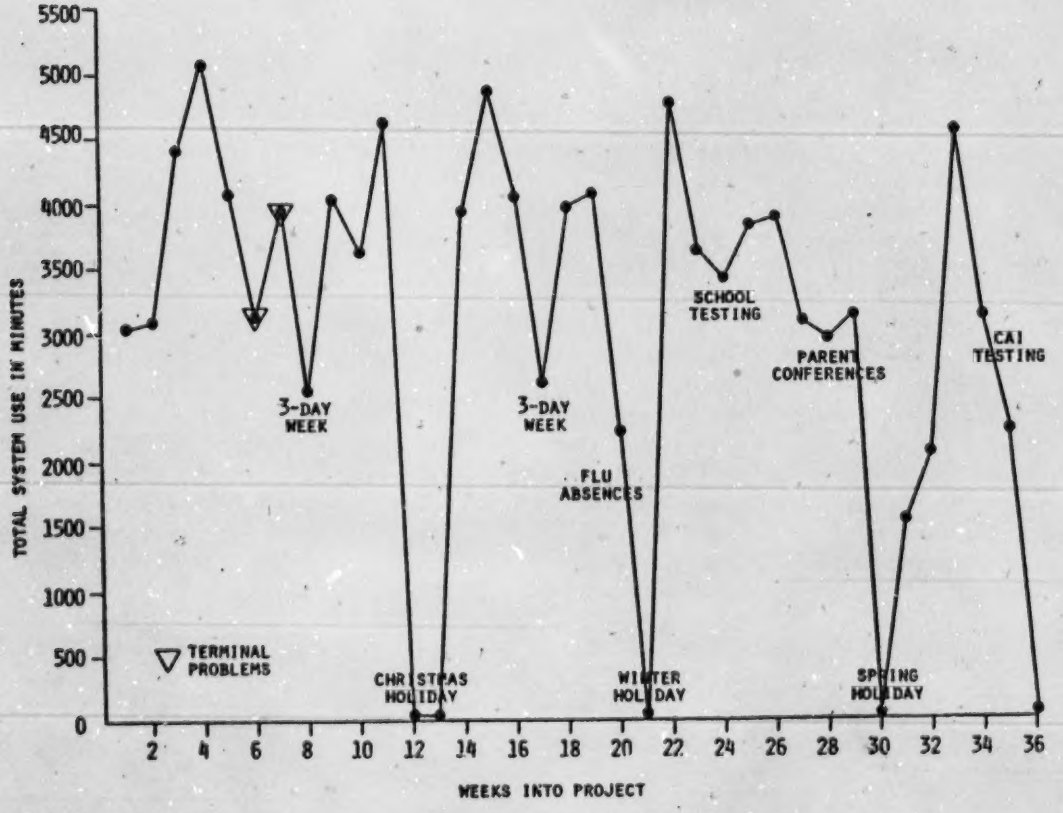


Figure 3. Total number of lessons taken and system use.

This range of the use among the participating schools indicates that differences existed between them in how CAI was integrated into their learning centers. Some of the observed differences in the structures of the learning centers that contributed to the usage variation are:

1. School's scheduling - In schools where teachers had fixed schedules for student use of the system, the usage rate was much higher than in schools where teacher assignment was less structured. It stands to reason that more efficient use of such a system can be accomplished through careful scheduling.

2. Level of student ability - The school that had the least usage was the one whose students' ability level was the lowest. This school was a self-contained classroom of EMR elementary school students. Because their ability to read printed text was limited, the kinds of lessons that could be created by the ASSIST models were limited. For this group, a system that could present audio and graphic materials would have proven to be more useful.

3. Group versus individual instruction - In some learning centers, group presentations were more frequent than individual instruction. In such centers, it was more difficult to release students from the group instruction and assign them to individual work at the terminal. When terminals are placed in learning centers as a resource, as opposed to situations where computer labs exist to handle an entire class at one time, teachers need to plan more carefully both the classroom and the terminal activity, and it is easier to assign students to use terminals if instruction is predominantly individualized. If group instruction is the predominant mode, then more terminals in the center are necessary to maximize student usage per day and ease the scheduling effort. However, it is currently not economically possible to provide a terminal for each student in the class.

4. Degree of program establishment - Because this CAI project emphasized teacher-developed curriculum materials and did not provide a ready-made instructional program, ASSIST was most useful for teachers who had an established teaching program and who could translate the paper-and-pencil procedures to ASSIST lesson formats. In centers where teachers did not have a well defined program, it proved more difficult for them to manage and integrate the CAI program with the rest of their classroom activities.

5. Teacher involvement - Since ASSIST is a teacher-controlled system, probably the greatest factor determining the extent of its use was teacher involvement. Although all teachers

Table 1

Total CAI Usage by Schools, October 1977 - May 1978

School	Number of Students in Program Entire Year	Total No. of Lessons Taken	Total Time on System in Min.	Average No. of Lessons per Student	Average Lessons per Student per Week	Average Student Time on in Min.	Average Student Time on per Week
A	11	603	3,702	55	2.75	337	17
C	25	1,720	11,629	69	3.50	465	23
E	11	1,760	9,794	160	8.00	890	45
G	22	2,300	11,598	105	5.25	527	26
K	32	2,883	21,323	90	4.50	666	34
M	15	3,480	28,832	232	11.60	1,922	96
O	27	3,271	20,673	121	6.00	766	38
S	21	1,353	6,155	65	3.25	293	15
Totals	164	17,370	108,706	160	5.30	663	33

were supportive of the project, some made more effort to apply the system to their classroom program, whereas others were more reluctant to do so.

At the outset, this CAI project was intended as a supplement to classroom instruction, not as a central instructional medium. The data indicate that student use was relatively low in comparison to total classroom time, but the extent of use was consistent with the project's intent and was what could be expected in the first year of operation, given the following limitations: (a) hardware resources were necessarily limited to a few terminals per center, thus requiring more scheduling effort on the part of the teacher; (b) only two of the learning centers were self-contained and in the others students came to the center for limited time periods; (c) teachers not only had to schedule students, but also had to develop and sequence their instructional materials in this first year of operation--a process that was demanding of their time and preparation. Given these scheduling and first-year constraints, usage was quite remarkable.

Lesson creation. A unique feature of the ASSIST system is the easy authoring capabilities that it gives teachers. The extent of teacher authoring is represented in Table 2, which shows the number of lessons created each month of the project by subject area and by model type. A total of 975 lessons were available on ASSIST at the end of the project year. Of these, the 164 DRILL lessons were created by the project developers prior to the program's operation, due to the standard nature of the subject matter. The remaining 811 lessons were authored by the 14 participating teachers, averaging 57 lessons per teacher or an overall average of 90 lessons per month. Most of the lessons, however, were created during the first four months of operation; the need for new lessons diminished as the library of lessons increased during the year.

An examination of the model usage indicates that the most frequently used model was COPY, which was suitable for presenting vocabulary lists and giving practice in spelling. Because the SPELL model was not introduced until January, COPY was used for spelling drills, which accounts for the less frequent use of SPELL. Another frequently used model was QUESTION, which, in addition to its use for direct questions and fill-in-the-blank type exercises, allowed easy spatial formatting of lesson items that was particularly useful for students who were visually distractable. QUESTION was also often used for personal lessons that provided exercises on student's biographical information such as address and age. The rest of the models were about equal in their use. Possible reasons for the more abundant use of COPY and QUESTION are that their lesson entry was simple, their format was similar to the most commonly used in the classroom, and the student response required was the most straightforward. However, many

Table 2

Number of Lessons Available Each Month, by Subject Area and Model Type

Date	Subject Areas			Total	Models									
	Read	Lang	Math		BI	CH	CO	DR	MA	NA	PO	QU	SP	TA
10/3/77	145	23	164	332	20	13	68	164	16	--	12	22	--	17
11/1/77	248	51	193	492	30	30	141	164	27	—	15	65	—	20
12/2/77	355	77	223	655	31	34	249	164	27	2	20	101	—	27
1/1/78	311	81	223	615	31	36	189	164	27	2	20	119	—	27
2/1/78	409	90	240	739	32	47	268	164	29	5	22	140	5	27
3/1/78	481	91	251	823	35	58	306	164	31	10	22	161	8	28
4/1/78	538	99	276	913	35	62	339	164	34	20	24	194	9	32
5/1/78	557	100	285	942	35	63	346	164	34	31	24	204	9	32
6/1/78	581	106	288	975	37	64	360	164	37	36	24	212	9	32

sophisticated and interesting lessons were created using the other models and together these models proved to provide a rich and valuable variety of lesson formats.

Table 3 presents the number of lessons created for each category for the three subject areas: reading, math, and language arts. Of the 811 teacher-created lessons, 687 were in language arts and reading and 124 in math. It is interesting to note that in the past, CAI projects have been predominantly oriented towards math drill and practice and lacked adequate lessons in reading or language. The ASSIST model formats seemed to lend themselves easily to the creation of simple language lessons and thus filled this need in their development. The greatest number of lessons developed in the reading and language areas were in vocabulary development, followed by lessons in factual detail, main ideas, and sentence structure. In math, the additional teacher-developed lessons were in multiplication and number concepts.

The lesson creation process changed during the course of the project. Whereas initially teachers were more concerned with the mechanics of entering a lesson into the system, once they mastered this procedure, their efforts were directed toward creating more imaginative and sophisticated lessons; thus, the quality of lessons noticeably improved as the teachers became more comfortable with using the system. Some of the more resourceful uses of the authoring capabilities included:

(a) Using different models to create a series of lessons on the same topic. For example months of the year were introduced through the COPY model, and presented for identification through the TARGET model, for association through the MATCH model, and for practical application through the QUESTION model. In this way, students received practice on a topic in a variety of ways.

(b) Creating personal lessons for individual students that gave them practice with biographical information about themselves such as their name, address, telephone number, birthdate and school.

(c) Using off-line materials such as tape recorder, charts, books, pictures to complement CAI lessons. For example, a chart of the human body with its parts labeled by numbers was used with a QUESTION lesson on the body.

(d) Entering student-written stories into the NARRATIVE model so that students could see their own stories in print.

The authoring capabilities proved to be simple and useful. Whereas 40 hours of development time for one hour of instructional material has been a rule of thumb for developing CAI lessons, the ASSIST models and programs enabled teachers to create a lesson in a matter of minutes. This ease of authoring resulted in numerous lessons being created during the demonstration year.

Table 3

Number of Lessons Created for Subject Area Categories

Reading Categories	Number of Lessons	Math Categories	Number of Lessons	Lang. Arts Categories	Number of Lessons
Figure-Ground	0	Addition	65	Abbreviations	0
Form Constancy	2	Decimals	10	Adjectives	5
Position in Space	3	Division	37	Adverbs	6
Spatial Relationships	9	Equations	2	Articles	0
Visual Memory	3	Fractions	3	Capitalization	4
Alphabet	6	Geometry	0	Vocabulary	24
Blends/Digraphs	4	Measurement	6	Comparatives	1
Consonants	10	Metric	0	Conjunctions	1
Vowel Sounds	14	Multiplication	93	Contractions	3
Compound Words	4	Negative Numbers	0	Nouns - common	0
Prefixes	7	Number Concepts	30	Nouns - proper	3
Sight word vocabulary	58	Percents	0	Negatives	0
Spelling vocabulary	246	Problem Solving	0	Possessives	0
Suffixes	1	Subtraction	42	Punctuation	6
Syllabication	6			Prepositions	1
Root Words	3			Pronouns	4
Antonyms	0			Quotations	2
Homonyms	7			Sentence Structure	25
Synonyms	1			Verbs	21
Vocabulary development	60				
Classification	2				
Analogies	0				
Conclusion Inference	0				
Context	0				
Factual/Detail	75				
Main Ideas	57				
Dictionary Skills	3				
Organizational Skills	0				
Total	581	Total	288	Total	106

Lesson use and sharing. Upon a student's completion of a lesson, the system updated a lesson usage file that indicated the number of times a lesson had been used and which school used it. From this file we determined the amount of lesson use and sharing, which is presented in Table 4. Personal lessons and lessons created for a series used only in the originating school were eliminated from this tally. The data indicate that on an average, a lesson was used 22 times, of which approximately 57% of its use was by the originating school and 43% by other schools. This indicates that teachers did use lessons created by other teachers and that the sharing network was effective.

In summary, the goals of the project to demonstrate the reliability of a CAI system for the handicapped and the usefulness of a teacher-controlled system were achieved. Many good lessons were created and shared in their use. Students used the system as a supplement to instruction on a regular basis.

Cognitive Impact

The main objective of our cognitive assessment effort was to see whether or not the treatment group students benefited cognitively from the project. In addition, we were interested in investigating whether the CAI program had a different impact on the different ages and types of handicapped children.

Research design. A matched group design was used for the cognitive evaluation. For each of the four elementary and four junior high school subgroups in the treatment group, a control group from other CUSD schools was selected whose population was similar in age, in the type of handicap, and in socioeconomic status. A match could not be found within CUSD for the treatment group in school M, which was a self-contained junior high school group of EMR students. Their control group was found in a neighboring school district.

Pretests and posttests were administered to all the students in the treatment and control group. The tests used were the KeyMath Diagnostic Arithmetic Test and the Reading Recognition and Reading Comprehension subtests of the Peabody Individulized Achievement Test (PIAT). The KeyMath is a preschool through sixth grade, individually administered test covering areas of arithmetic computation and application. It requires almost no reading or writing ability. Similarly, the PIAT is a wide-range, individually administered test, with suitable content in the reading areas. For both tests, item-selection rules based on student responses are used to administer only those items that are of appropriate difficulty for the student. These tests are particularly suitable for children with learning handicaps because they are individually administered and have adaptive item selection rules such that: (a) students are less likely to misunderstand instructions, (b) students are presented only those items that are suitable for their level, and (c) students are not penalized for responding slowly.

Table 4

Amount of Use and Sharing of Created Lessons
for Each Subject Area

Subject Area	Number of Lessons	Total No. of Times Lessons Used	Average No. of Times Lessons Used	Average % of use in Originating School	Average % of use by Other Schools
Reading	234	5406	23	56	44
Math 1	115	1587	14	59	41
Math 2*	164	3258	20	—	100
Language	97	2106	22	55	45

*RMC-created

Eight testers were trained to administer these tests. Testers were randomly assigned to treatment and control schools. Pretests were administered in September 1977; posttests were administered in May 1978. On an average, one hour was required to test each student at each of the two testing times. Only those children with both pretest and posttest scores were included in the evaluation. Although the total number of students enrolled in the CAI project was 216, the number of students with both pretest and posttest scores was 164; this discrepancy is mainly due to students moving in and out of the centers and schools during the academic year. The number of control students with both pretest and posttest scores was 124. Table 5 presents the numbers of students with both pretest and posttest scores, their handicap types, and the mean age of each of the treatment school and matched control school groups. Note that the same junior high school served as the control group for school D and school C.

Data analysis and results. For each of the treatment and control groups, the means and standard deviations of their pretest and posttest raw scores for all three tests, and the correlations between the pretests and posttests were computed. Although each treatment and control group was matched for ability, differences in the mean pretest level often occurred. To account for the differences in the pretest scores, the control groups' posttest scores were adjusted, based on pretest differences, using the analysis of covariance method of adjustment. Gains for each group were computed by subtracting the pretest scores from the posttest scores. The control group gain was then subtracted from the treatment group gain to obtain the treatment gain score (beyond the control group's gain). An adjusted treatment gain was also computed by comparing the treatment group posttest with the adjusted control group posttest. Finally, a T-test for significant mean differences between the treatment group posttest score and the control group adjusted posttest score was computed. All the above described statistics are presented in Table 6.

Scatter plots comparing the pretest and posttest scores of each treatment group with its control group for each of the three tests are displayed in Figures 4, 5, and 6.

First the scatter plots indicate that the testing was reasonably reliable, with good pretest-posttest correlations (mostly in the 90s), few outliers, and no evidence of test non-linearity. As can be expected from differences in subject matter, the reliability of the math testing was highest and that of reading comprehension was the lowest. The dispersion of scores as shown by the standard deviations and the scatter plots was substantial, which indicates a wide range of student ability in most groups.

The treatment group gains were positive in 3/4 of the cases and significant at the 80% level in nearly half the cases. This overall,

Table 5

Comparison of Treatment Schools and Their Matched Control Schools for Age and Handicap Types

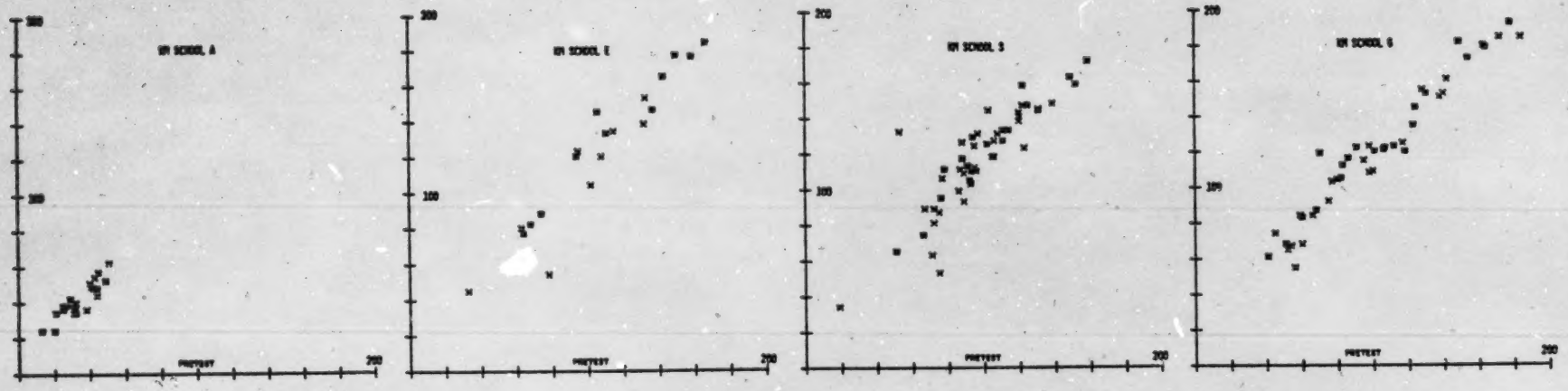
	TREATMENT GROUP						CONTROL GROUP					
		Handicap Type						Handicap Type				
School	N	EMR	SOLC	LDG	EHM	Mean Age	N	EMR	SOLC	LDG	EHM	Mean Age
A	11	11				10.8	11	11				11.0
E	11		2	4	5	10.5	9			9		9.4
S	21		1	16	4	10.2	29			24	5	10.0
G	22		10	11	1	10.2	25		12	8	5	10.0
Jr. Hi.												
K	32	1	9	13	9		24		6	11	7	
O	27	3	2	17	5	13.4	19			8	11	13.4
C	25		5	18	2	13.5	19			8	11	13.4
M	15	15				13.9	7	7				14.8

Table 6. Summary Statistics for Treatment and Control Groups by School

School	Test	TREATMENT GROUP						CONTROL GROUP						GAINS					
			Pretest		Posttest		Corr. Pre/		Pretest		Posttest		Corr. Pre/	Posttest minus Pretest		Treatment Gain			
Elem.		N	Mean	SD	Mean	SD	Post	N	Mean	SD	Mean	SD	Post	Treatment	Control	Beyond Control Group	Adjusted	T	1 - α
	KM	11	28.7	9.9	37.1	8.2	.91	11	39.9	5.9	46.5	8.7	.88	8.4	6.6	1.8	1.96	*.64*	*.70*
A	RR	11	15.7	4.9	19.5	2.2	.51	11	21.9	3.2	23.8	3.4	.84	3.8	1.9	1.9	-.79	*-.66*	*.75*
	RC	11	15.2	4.4	19.7	2.3	.34	11	21.5	3.4	21.5	2.9	.88	4.5	0	4.5	1.18	*1.07*	*.85*
	KM	11	115.7	35.9	135.7	37.6	.98	9	95.4	30.9	105.7	35.9	.92	20.0	10.3	9.7	8.85	*.64*	*.70*
E	RR	11	31.4	9.2	38.2	8.8	.95	9	33.7	13.0	35.4	11.9	.88	6.8	1.7	5.1	4.71	*1.01*	*.85*
	RC	11	31.5	10.1	38.6	10.8	.90	9	31.8	12.4	36.0	12.2	.70	7.1	4.2	2.9	2.90	*.56*	*.70*
	KM	21	104.5	27.4	123.5	27.3	.95	29	93.4	25.2	112.5	28.9	.81	19.0	19.1	-.1	.65	*.08*	--
S	RR	21	31.1	8.1	36.9	7.9	.94	29	30.2	10.1	36.2	10.3	.90	5.8	6.0	-.2	-.20	*-.07*	--
	RC	21	30.0	9.7	37.7	9.8	.84	29	32.2	12.9	36.4	10.9	.79	7.7	4.2	3.5	3.02	*1.00*	*.85*
	KM	22	107.3	37.6	128.1	36.0	.97	23	94.7	38.8	110.9	37.4	.98	20.8	16.2	4.6	5.34	*.49*	*.70*
G	RR	22	34.8	12.2	41.4	12.3	.97	23	31.7	9.7	35.3	9.0	.93	6.6	3.6	3.0	3.29	*1.03*	*.85*
	RC	22	36.3	13.4	41.1	12.3	.94	23	29.5	11.2	34.3	9.6	.83	4.8	4.8	0	1.51	*.46*	*.70*
Jr.Hi.																			
	KM	32	147.7	18.3	157.7	19.1	.87	24	158.5	16.7	162.6	17.5	.92	10.0	4.1	5.9	5.00	*1.00*	*.80*
K	RR	32	42.7	11.3	45.1	10.2	.92	24	47.4	8.8	48.8	8.1	.90	2.4	1.4	1.0	.24	*.10*	--
	RC	32	42.4	8.5	47.4	10.6	.75	24	46.0	9.0	50.4	10.4	.64	5.0	4.4	.6	-.05	*-.02*	--
	KM	27	148.6	29.7	149.4	30.1	.98	19	149.3	25.0	156.8	24.5	.94	.8	7.5	-6.7	-6.70	*-.80*	*.80*
O	RR	27	42.3	10.3	47.8	11.7	.94	19	46.0	10.3	43.0	10.7	.89	5.5	-3.0	8.5	8.50	*2.54*	*.99*
	RC	27	46.9	13.5	46.7	10.9	.86	19	45.5	12.0	47.2	13.1	.85	-.2	1.7	-1.9	-1.39	*-.45*	--
	KM	25	145.1	18.7	163.0	17.5	.86	19	149.3	25.0	156.8	24.5	.94	17.9	7.5	10.4	9.78	*1.55*	*.90*
C	RR	25	46.7	11.0	49.0	9.2	.95	19	46.0	10.3	43.0	10.7	.89	2.3	-3.0	5.3	5.37	*1.60*	*.95*
	RC	25	42.0	6.9	47.5	6.1	.74	19	45.5	12.0	47.2	13.0	.85	5.5	1.7	3.8	3.00	*1.01*	*.85*
	KM	15	70.5	30.5	85.9	34.4	.98	7	66.7	14.0	77.0	17.4	.90	15.4	10.3	5.1	4.75	*.34*	--
M	RR	15	33.7	12.2	35.8	12.5	.98	7	28.6	8.0	31.3	9.0	.99	2.1	1.7	.4	.10	*.02*	--
	RC	15	30.7	10.9	31.5	9.0	.87	7	24.7	5.7	28.6	3.5	.87	.8	3.9	-3.1	-1.09	*.30*	--

KM = KeyMath
RR = PIAT Reading Recognition
RC = PIAT Reading Comprehension

ELEMENTARY



JUNIOR HIGH

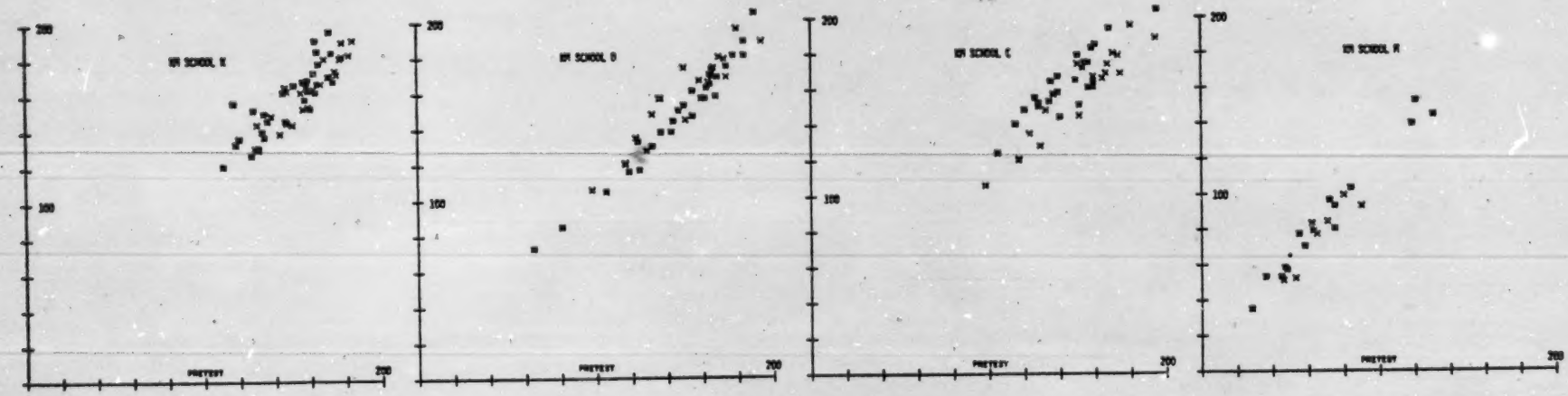


Figure 4. Keymath pretest and posttest raw score scatter plots for each treatment school (*) and their matched control school (x).

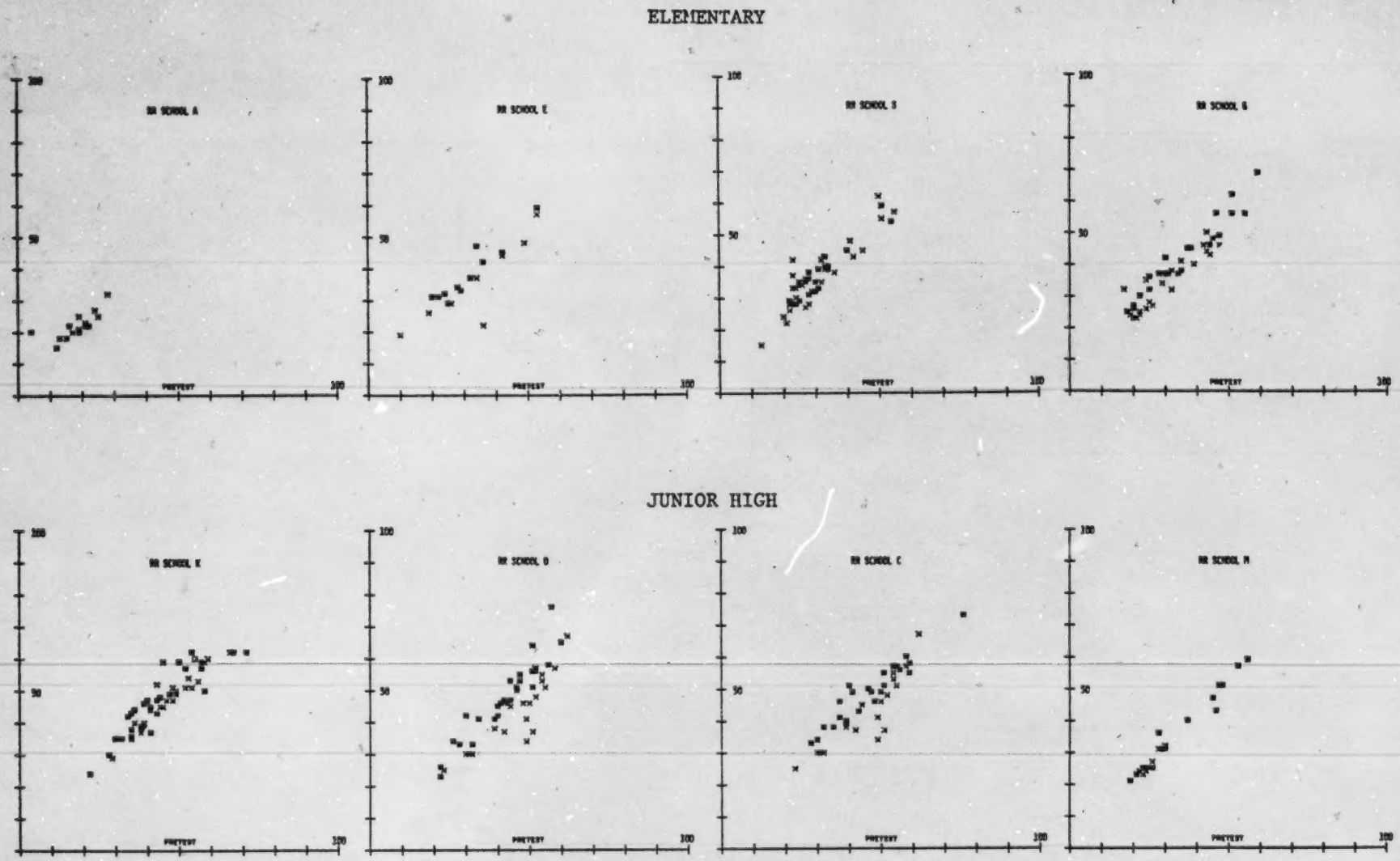
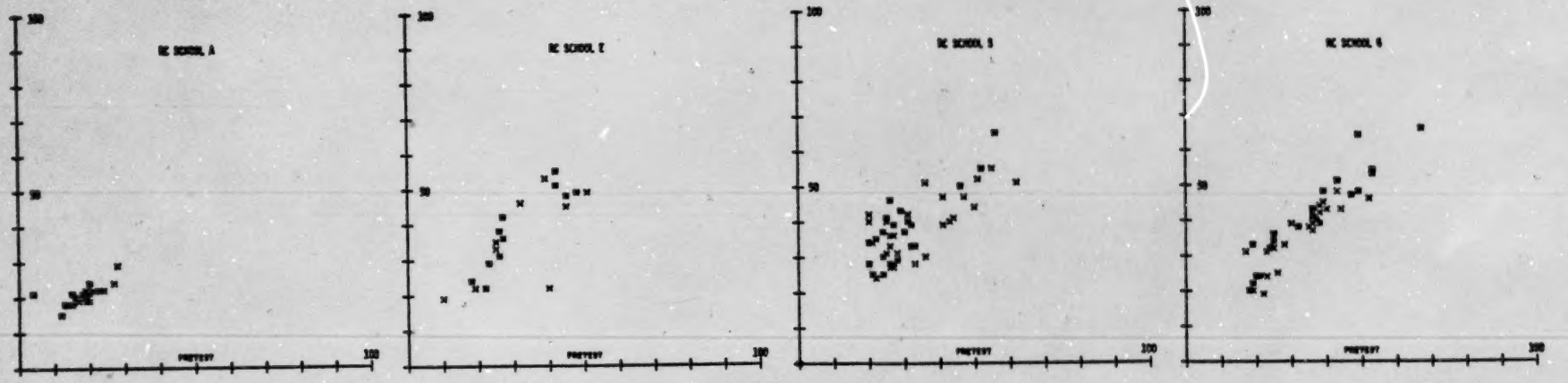


Figure 5. Piat Reading Recognition pretest and posttest raw score scatter plots for each treatment school (*) and their matched control school (x).

ELEMENTARY



JUNIOR HIGH

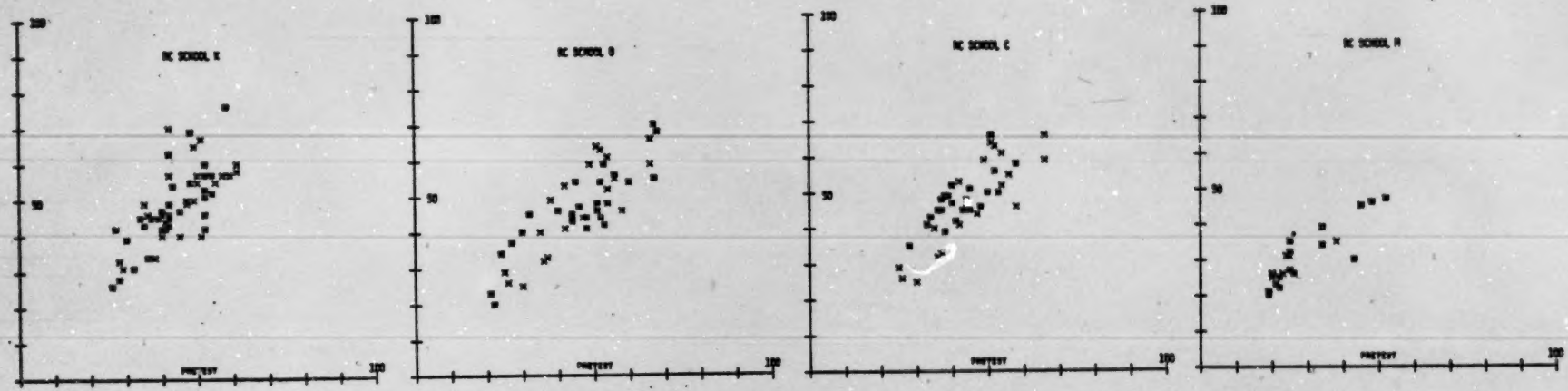


Figure 6. Piat Reading Comprehension pretest and posttest raw score scatter plots for each treatment school (*) and their matched control school (x).

moderate gain for the treatment group is a reasonable outcome, given the fact that student time on the computer was limited to about 30 minutes per week. In fact, a larger gain would be more difficult to explain. The highest gains were made in the reading recognition test, followed by math, then by reading comprehension. This result is also not difficult to explain, since most of the CAI lessons created were drills in reading recognition skills. Reading comprehension is much more difficult to teach with such exercises.

Some of the individual school results were also not surprising. For example, in school O, our observations indicated that computer usage was most emphasized by the reading teachers and less so by the math teacher; thus, the significant gain in reading recognition and a significant loss in mathematics are not surprising. In another case, school M is a self-contained classroom of EMR junior high school students. Even though this group made most thorough and efficient use of the system, their gains were not significant. The nature of their handicap precludes our expectation of much gain.

To validate the results of the control group evaluation, we further compared the treatment group's performance with the national norm data provided by the test publishers. Table 7 presents percentile standings and related NCE gains for the treatment groups. School A was below the lowest recorded percentile for the norms, thus results are not presented. These results are generally in agreement with those obtained from the control group evaluation. As a benchmark, 7 NCEs correspond to 1/3 of a standard deviation in the national norming sample. Those groups that attained over 7 NCE gains were the same groups whose gains over their control groups were most significant; note also that these higher gains were attained in junior high schools. In some cases, the norm-comparison (and raw score differences) indicate a noticeable gain when the control group comparison indicates no particularly significant results (e.g., school E, KeyMath test; school M, KeyMath). This difference can be attributed to the rather large sample standard deviations, which in these cases attenuate the covariance adjustment comparison but not the norm comparison. In other cases, control groups made comparably large gains, which reduced the significance of the apparently large treatment group raw score gain (e.g., school G, KeyMath test; School S, KeyMath test). The comparable results from both evaluation methods provide us with some confidence in the existence of a moderate overall gain for the treatment group students.

In the interest of determining whether the treatment interacted differently with students of different handicaps, a 2 x 4 factor analysis of covariance, with the pretest as the covariate and the handicap type and treatment as the two variates, was computed separately for the junior high and the elementary schools for each of the three tests. The results are

Table 7

Treatment School Pretest and Posttest Scores and Gains
based on National Norms

Elementary School	Test	Mean Raw Score Pre	Mean Raw Score Post	Percentile Pre	Percentile Post	NCE Pre	NCE Post	NCE Gain
A	KM	29	37	—	—	—	—	—
	RR	16	20	—	—	—	—	—
	RR	15	20	—	—	—	—	—
E	KM	116	136	38	44	43.6	46.8	3.2
	RR	31	38	29	34	38.3	41.3	3.0
	RC	32	39	33	37	40.7	43.0	2.3
S	KM	105	124	24	25	35.1	35.8	.7
	RR	31	37	29	30	38.3	39.0	.7
	RC	30	38	28	34	37.7	41.6	3.9
G	KM	107	128	26	31	36.0	40.0	4.0
	RR	35	41	39	43	44.1	46.3	2.2
	RC	36	41	42	43	45.8	46.3	.5
Junior High								
K	KM	148	158	26	32	36.5	40.1	3.6
	RR	43	45	18	19	30.7	31.5	.8
	RC	42	47	19	27	31.5	37.1	5.6
O	KM	149	150	28	22	37.7	33.7	-4.0
	RR	42	48	16	28	29.1	37.7	8.6
	RC	47	47	34	27	41.3	37.1	-4.2
C	KM	145	163	22	42	33.7	45.8	12.1
	RR	47	49	29	30	38.3	39.0	.7
	RC	42	48	19	30	31.5	39.0	7.5
M	KM	71	86	7	10	18.9	23.0	4.1
	RR	34	36	6	6	17.3	17.3	—
	RC	31	32	6	6	17.3	17.3	—

presented in Table 8. Note from this table that the treatment effect was significant at .90 or above for four out of six possible combinations of test and school levels. Handicap type was a significant correlate of test performance for the reading comprehension test in the elementary schools. The interaction of treatment and handicap type was significant only in the case of reading comprehension in the junior high school.

Table 9 breaks down summary statistics for treatment and control groups by handicap type and test in a way analogous to Table 6. Scatter plots were examined but are not included here because they provide no significant additional information not already provided by Table 9. The previously noted interaction between treatment and handicap type for junior high schools on the reading comprehension test is evidenced by the mixture of significant gain and loss for that combination of groups in Table 9. The analyses by handicap types are in agreement with the overall picture of moderate gains for the treatment group. The higher level of significance for the treatment effect in the covariance analysis is largely due to its inclusion of differences in variances in its computation--the differences in the sample standard deviations were very large (e.g., junior high, EMR, KeyMath test).

In summary, results of the cognitive outcome evaluation seem to be reliable and indicative of cognitive benefits to the students from their exposure to CAI. This can be considered a remarkable result, given that students spent an average of only 30 minutes per week taking CAI lessons.

Questionnaires

To assess the opinions of teachers, students, and principals towards the CAI project, questionnaires were administered to these groups at the end of the demonstration year. In addition, teachers were given questionnaires at the beginning and middle of the project to follow their progress. (These questionnaires with results and comments are attached in Appendix B).

Teacher opinions. On the whole, the participating teachers were highly favorable to the use of CAI throughout the demonstration period with 83% being very satisfied with the project and 87% viewing CAI as a very useful and promising method of supplementary instruction. When asked their opinion of the approach of this project, where teachers develop and share lesson materials, 94% thought it very effective and liked it very much. Teachers estimated that they spent two to three hours per week preparing lessons for the CAI project, and 83% thought it was a very worthwhile use of their time. About half of the teachers thought lessons created by other teachers were very useful and half thought they were somewhat useful. Forty-two percent of the teachers said they created one-fourth of the lessons they assigned; 19% created one-half of the lessons; 24% created three-fourths of the lessons; 15% created all the lessons. These results indicate that most teachers liked the control of lesson creation and lesson selection,

Table 8

Analysis of Covariance (2x4) with Pretest as Covariate and Handicap Type and Control/Treatment as Variates

	Elementary				Junior High			
	SS	df	MS	F	SS	df	MS	F
KEYMATH								
Handicap Type	231.6	3	77.2	.33	1,498	3	499	3.99**
Treatment	77.3	1	77.3	.33	587	1	587	4.19**
Interaction	68.6	3	22.9	.10	143	3	48	.38
Within Cell	31,165	133	234		17,561	133	125	
PIAT READ.REC.								
Handicap Type	33.4	3	11.1	.29	43	3	14.3	.58
Treatment	110.5	1	110.5	2.89*	187	1	187	7.60***
Interaction	24	3	8	.20	84	3	28	1.14
Within Cell	5,092	133	38.3		3,275	133	24.6	
PIAT READ.COM.								
Handicap Type	430	3	143	2.23*	214	3	71.3	1.23
Treatment	189	1	189	2.95*	6.1	1	6.1	.01
Interaction	158	3	52.7	.82	532	3	177.3	3.06*
Within Cell	8,606	133	64		7,710	133	58	

*$F(3,120)_{.90} = 2.13$

**$F(3,120)_{.95} = 3.92$

***$F(3,120)_{.99} = 6.85$

Table 9. Summary Statistics for Treatment and Control Groups by Handicap Type

Handicap Type / Test		TREATMENT GROUP N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Corr. Pre/Post	CONTROL GROUP N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Corr. Pre/Post	GAINS: Posttest minus Pretest — Treatment	Posttest minus Pretest — Control	Treatment Gain — Beyond Control Group	Treatment Gain — Adjusted	T	1 - σ
Elem																			
EMR	KM	11	28.7	9.9	37.1	8.2	.91	11	39.9	5.9	46.5	8.7	.88	8.4	6.6	1.8	1.96	.64	.70
	RR	11	15.7	4.9	19.5	2.2	.51	11	21.9	3.2	23.8	3.8	.84	3.8	1.9	1.9	-.79	.65	.75
	RC	11	15.2	4.4	19.7	2.3	.34	11	21.5	3.4	21.5	2.9	.88	4.5	0	4.5	1.18	1.05	.85
SOLH	KM	13	100.3	36.6	119.8	38.1	.99	12	84.3	27.3	101.6	30.8	.97	19.5	17.3	2.2	1.32	.09	--
	RR	13	32.8	11.0	38.8	9.8	.96	12	33.3	9.4	36.3	9.8	.98	6.0	3.0	3.0	2.90	.74	.80
	RC	13	33.5	12.2	38.0	10.9	.94	12	29.1	12.8	33.5	10.1	.87	4.5	4.4	.1	1.22	.39	--
LDG	KM	31	112.9	32.2	132.3	30.2	.95	43	93.8	34.4	108.9	36.7	.91	19.4	15.1	4.3	5.51	.68	.75
	RR	31	32.5	9.4	39.2	9.3	.94	43	30.7	11.1	35.5	10.3	.90	6.7	4.8	1.9	2.07	.89	.80
	RC	31	33.6	12.0	39.4	11.7	.92	43	30.9	12.8	35.6	11.1	.77	5.8	4.7	1.1	1.76	.66	.75
EH	KM	10	102.5	32.6	124.6	34.7	.98	11	89.5	27.2	107.1	30.4	.90	22.1	17.6	4.5	4.23	.30	--
	RR	10	33.0	12.0	38.6	13.2	.99	11	27.0	7.9	31.2	8.9	.84	5.6	4.2	1.3	1.36	.28	--
	RC	10	29.5	9.8	40.6	9.7	.87	11	27.3	11.5	33.3	8.9	.74	11.1	6.0	5.1	5.75	1.42	.90
Jr.Hi.																			
EMR	KM	19	60.7	39.7	93.6	39.5	.98	7	66.7	14.0	77.0	17.4	.90	12.9	10.3	2.6	2.45	.16	--
	RR	19	33.5	11.6	36.3	11.3	.97	7	28.6	8.0	30.3	9.1	.995	2.8	1.7	1.1	.91	.18	--
	RC	19	31.3	10.7	32.6	9.6	.88	7	24.7	5.7	28.6	3.5	.87	1.3	3.9	-2.6	-.71	-.19	--
SOLH	KM	16	144.7	21.4	154.3	27.7	.83	6	150.8	17.8	153.0	19.6	.97	9.6	2.2	7.4	6.8	.67	.75
	RR	16	41.0	13.6	43.3	13.1	.97	6	45.2	5.2	46.7	3.8	.82	2.3	1.5	.8	.17	.03	--
	RC	16	38.8	8.9	43.6	11.3	.86	6	47.2	7.4	44.2	7.7	.81	4.8	-3.0	7.8	8.0	1.59	.90
LDG	KM	48	148.2	18.7	157.0	18.6	.83	19	155.4	23.0	160.8	22.3	.94	8.8	5.4	3.4	2.27	.47	--
	RR	48	45.5	10.0	48.9	9.6	.88	19	49.7	8.5	48.5	9.5	.86	3.4	-1.2	4.6	4.18	1.61	.95
	RC	48	44.9	10.5	48.6	8.3	.74	19	47.5	8.8	53.4	10.0	.53	3.7	5.9	-2.2	-3.28	-1.38	.90
EH	KM	16	153.8	20.3	166.4	22.6	.91	18	154.6	20.0	161.6	19.7	.91	12.6	7.0	5.6	5.47	.75	.75
	RR	16	44.1	9.6	47.6	8.7	.92	18	44.3	10.8	43.7	10.7	.89	3.5	-.6	4.1	4.03	1.19	.87
	RC	16	47.8	7.2	49.3	8.8	.63	18	43.4	12.2	45.9	13.0	.90	1.5	2.5	-1.0	-5.60	-.14	--

KM = KeyMath
RR = PIAT Reading Recognition
RC = PIAT Reading Comprehension

and participated actively in this process. Assignment of lessons to students and student scheduling seemed to be the areas of most problems for the teachers; few mentioned any difficulties with the authoring procedures or the mechanical aspects of the system's use.

Student opinions. After the posttest, students were interviewed by the testers with a brief set of questions regarding their views of the CAI project. Of the 113 students questioned, 85% liked the CAI project and felt the computer lessons helped them. Ninety-three percent thought it was fun, 84% did not think that it was a waste of their time, 75% thought it was neat and not boring, and 85% wanted the computer to stay in their learning center. Most student comments were favorable. Some of the reasons given for liking the project are: "It's friendly," "I like how it talks back to me," "It gives you a second chance," "It makes it easy to study."

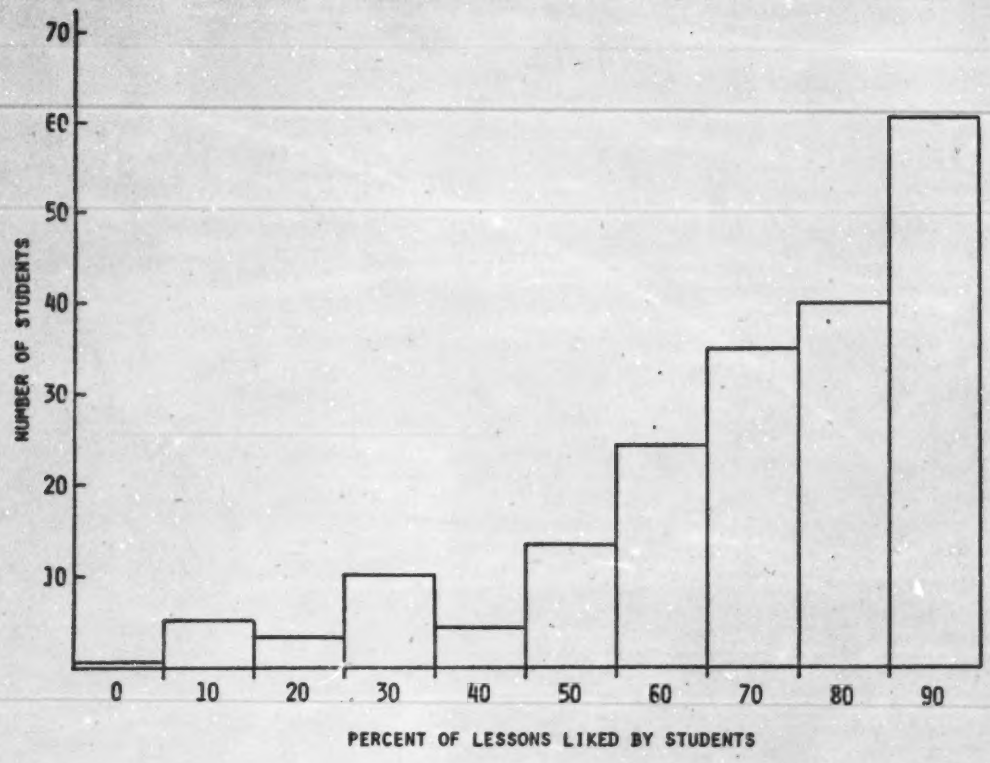
At the end of every lesson, the system also recorded student scores and student opinions on the lesson taken. Table 10 presents the means and ranges of these student scores and opinions by schools. On the whole, 76% of the students liked the lessons they took and attained an average score of 77. When asked whether these lessons were too easy, too hard, or just right, the majority of the students said the lessons were just right. Teachers were also asked their opinion of student attitude toward the CAI project. Eighty-three percent thought students were motivated and 78% thought students were enthusiastic and cooperative.

Principal opinions. Principals in the eight participating schools were supportive of the project from the start and highly favorable of its impact on special education. Eighty-seven percent of the principals felt CAI was a useful supplemental teaching method and in their opinion, students in the learning centers had benefited a great deal.

Table 10

Means and Ranges of Student Scores and Opinions on Lessons Completed

School	Number of Students	Scores (% correct) Mean	Scores (% correct) Range	Percent of Lessons Liked Mean	Percent of Lessons Liked Range
A	12	84	41-100	—	—
C	39	80	19-100	72	13-100
E	14	84	50-98	81	55-100
G	30	78	50-93	82	53-100
K	40	71	0-100	73	11-100
M	17	80	61-91	90	68-99
O	40	75	29-111	77	30-100
S	24	73	22-100	64	0-100
Total	216	77		76	



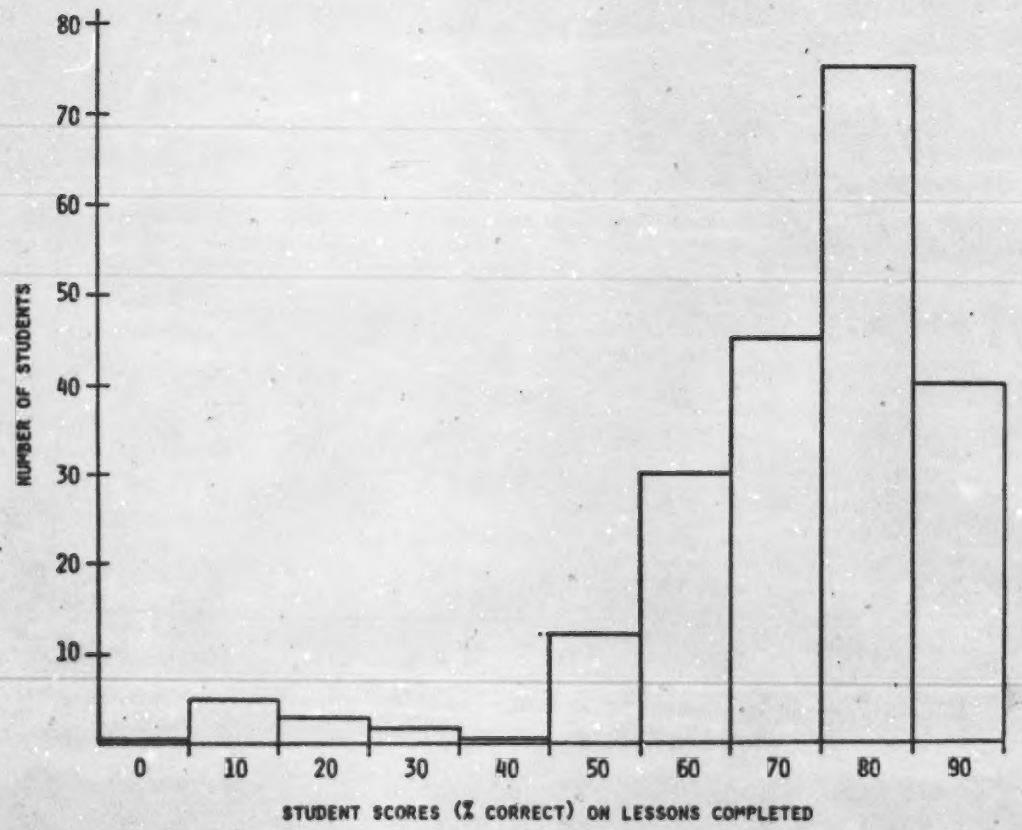


Figure 4. Frequency distribution of student opinion of lessons and student scores.

CONCLUSIONS AND RECOMMENDATIONS

The belief that CAI should serve teachers as a supplemental instructional resource in special education classrooms led us to the development of a teacher-controlled CAI system for special education that gave teachers easy authoring and student-management capabilities. This project demonstrated that such a system can operate reliably and successfully in special education classrooms, as evidenced by the ease with which teachers incorporated CAI instruction with their classroom activities, the large number of lessons they created, the extensive student use of the system, and the overwhelmingly positive response from teachers and students towards the system. Cognitive evaluation of the educational benefits of the system for handicapped students indicated that some gains were made by the treatment group students. Given the fact that this was the first year of operation and that students were exposed to the system for only appoximately 30 minutes per week, we consider such gains noteworthy.

We conclude that a teacher-controlled CAI system, such as the one developed for this project, is a useful and effective system for special education classrooms and make the following recommendations for its continued development:

(1) For some educationally handicapped students, the printed text is too limiting a medium for presenting instructional materials. The capability to present audio and graphic materials should be extended to future systems.

(2) One of the factors influencing the more limited student use of the system was that it was not economically feasible to have many terminals in one classroom. With the advent of microcomputers, it should be possible to afford several such stand-alone computers in one classroom. We recommend that the ASSIST system or the ideas of the system be translated into programs for microcomputers. The major logistic difficulty of using microcomputers is that there will be no default means of communicaton among users, and the sharing of lessons will have to be accomplished off-line, by a disc or tape library service.

(3) Individual educational plans are mandated by Congress for all special education students. The ASSIST system can be expanded to assist teachers in the management of students' IEPs by developing a student-management system component that relates students' classroom and computer activities with his/her IEP.

We hope that the ideas put forth in the ASSIST system and some of the above recommendations will be carried out in future development of CAI systems.

APPENDIX A

ASSIST Author Sheets

AUTHOR SHEET

LESSON INDEX INFORMATION B I _ _ _ _ _ _ _ _ _

Subject Area __ Category Number __ __ Level __

Author _____ School _____

Objective _____

LESSON CONTENT

Designated answer keys: [ ] to indicate _____ [ ] to indicate _____

Instruction: _____

*

#	Items	Correct answer key
1		* [ ]
2		* [ ]
3		* [ ]
4		* [ ]
5		* [ ]
6		* [ ]
7		* [ ]
8		* [ ]
9		* [ ]
10		* [ ]

#	Items	Correct answer key
11		* [ ]
12		* [ ]
13		* [ ]
14		* [ ]
15		* [ ]
16		* [ ]
17		* [ ]
18		* [ ]
19		* [ ]
20		* [ ]

LESSON OPTIONS: Do you want to modify standard options [Y] or [N] ____

If YES:

Presentation order: [S] sequential or [R] random ___

Time out: If not standard, specify seconds ___

Correct answer reinforcers other than standard

1 _____

2 _____

3 _____

Stars: [N] or [Y] _____

Wrong answer response on first try other than standard:

_____

Wrong answer response on subsequent tries other than standard:

_____

Optional wrong answer hint: None [RETURN]

Repeat Instructions [I] _____

or specify other:

_____ *

AUTHOR SHEET

Choice

LESSON INDEX INFORMATION C H ___ ___ ___ ___ ___ ___

Subject Area __ Category Number __ __ Level __

Author _____ School _____

Objective _____

LESSON CONTENT:

Model Options: Student answer: word [W] or letter [L] ___

Instructions: _____

_____

*

LESSON ITEMS

( ) Question:

*

Choices: A _____ B _____ C _____ D _____

Answer _____

( ) Question:

*

Choices: A _____ B _____ C _____ D _____

Answer _____

( ) Question:

*

Choices: A _____ B _____ C _____ D _____

Answer _____

( ) Question:

*

Choices: A _____ B _____ C _____ D _____

Answer _____

( ) Question:

*

Choices: A _____ B _____ C _____ D _____

Answer _____

( ) Question:

*

Choices: A _____ B _____ C _____ D _____

Answer _____

Use another author sheet to enter up to 20 questions.

LESSON OPTIONS: Do you want to modify standard options [Y] or [N] ____

If YES:

Presentation order: [S] sequential or [R] random ___

Time out: If not standard, specify seconds ___

Correct answer reinforcers other than standard

1 _____

2 _____

3 _____

Stars: [N] or [Y] _____

Wrong answer response on first try other than standard:

_____

Wrong answer response on subsequent tries other than standard:

_____

Optional wrong answer hint: None [RETURN]

Repeat Instructions [I] _____

or specify other:

_____ *

AUTHOR SHEET

Copy

LESSON INDEX INFORMATION C O _ _ _ _ _ _ _ _ _ _

Subject Area __ Category Number __ __ Level __

Author _____ School _____

Objective _____

LESSON CONTENT:

Model Options: Copy [C] or Recall [R] _____

If Recall, number of seconds before X-ing _____

Instructions: _____

_____

*

Items	Items
1	11
2	12
3	13
4	14
5	15
6	16
7	17
8	18
9	19
10	20

LESSON OPTIONS: Do you want to modify standard options [Y] or [N] ____

If YES:

Presentation order: [S] sequential or [R] random ___

Time out: If not standard, specify seconds ___

Correct answer reinforcers other than standard

1 _____

2 _____

3 _____

Stars: [N] or [Y] _____

Wrong answer response on first try other than standard:

_____

Wrong answer response on subsequent tries other than standard:

_____

Optional wrong answer hint: None [RETURN]

Repeat Instructions [I] _____

or specify other:

_____ *

Match

AUTHOR SHEET

LESSON INDEX INFORMATION M A _ _ _ _ _ _ _ _ _ _

Subject Area __ Category Number __ __ Level __

Author _____ School _____

Objective _____

LESSON CONTENT:

Model Option: Student answer: word [W] or letter [L] __

Instructions: _____

_____

*

List A Items	List B Items
1	A
2	B
3	C
4	D
5	E
6	F
7	G
8	H
9	I
10	J

LESSON OPTIONS: Do you want to modify standard options [Y] or [N] ____

If YES:

Presentation order: [S] sequential or [R] random ___

Time out: If not standard, specify seconds ___

Correct answer reinforcers other than standard

1 _____

2 _____

3 _____

Stars: [N] or [Y] _____

Wrong answer response on first try other than standard:

_____

Wrong answer response on subsequent tries other than standard:

_____

Optional wrong answer hint: None [RETURN]

Repeat Instructions [I] _____

or specify other:

_____ *

Narrative

AUTHOR SHEET

LESSON INDEX INFORMATION N A _ _ _ _ _ _ _ _ _ _

Subject Area __ Category Number __ __ Level __

Author _____ School _____

Objective _____

LESSON CONTENT:

Narrative

1 /
2 /
3 /
4 /
5 /
6 /
7 /
8 /
9 /
10 /
11 /
12 /
13 /
14 /
15 /
16 /
17 /
18 /
19 /
20 /
21 /
22 /
23 /
24 /
25 *

LESSON OPTIONS: Do you want to modify standard options [Y] or [N] ____

If YES:

Presentation order: [S] sequential or [R] random ___

Time out: If not standard, specify seconds ___

Correct answer reinforcers other than standard

1 _____

2 _____

3 _____

Stars: [N] or [Y] ____

Wrong answer response on first try other than standard:

_____

Wrong answer response on subsequent tries other than standard:

_____

Optional wrong answer hint: None [RETURN]

Repeat Instructions [I] _____

or specify other:

_____ *

AUTHOR SHEET

Position

LESSON INDEX INFORMATION P O _ _ _ _ _ _ _ _ _

Subject Area __ Category Number __ __ Level __

Author _____ School _____

Objective _____

LESSON CONTENT:

Model Options: Number words [W] or spaces [S] ____

Instructions: _____

_____

*

LESSON ITEMS

( ) Sentence: _____ _____ _____ _____

1 2 3 4

_____ _____ _____ _____ _____

5 6 7 8 9

Correct answer numbers

( ) Sentence: _____ _____ _____ _____

1 2 3 4

_____ _____ _____ _____ _____

5 6 7 8 9

Correct answer numbers

( ) Sentence: _____ _____ _____ _____

1 2 3 4

_____ _____ _____ _____ _____

5 6 7 8 9

Correct answer numbers

( ) Sentence: _____ _____ _____ _____

1 2 3 4

_____ _____ _____ _____ _____

5 6 7 8 9

Correct answer numbers

( ) Sentence: _____ _____ _____ _____

1 2 3 4

_____ _____ _____ _____ _____

5 6 7 8 9

Correct answer numbers

( ) Sentence: _____ _____ _____ _____

1 2 3 4

_____ _____ _____ _____ _____

5 6 7 8 9

Correct answer numbers

( ) Sentence: _____ _____ _____ _____

1 2 3 4

_____ _____ _____ _____ _____

5 6 7 8 9

Correct answer numbers

Use another author sheet to enter up to 20 items.

LESSON OPTIONS: Do you want to modify standard options [Y] or [N] ____

If YES:

Presentation order: [S] sequential or [R] random ___

Time out: If not standard, specify seconds ___

Correct answer reinforcers other than standard

1 _____

2 _____

3 _____

Stars: [N] or [Y] _____

Wrong answer response on first try other than standard:

_____

Wrong answer response on subsequent tries other than standard:

_____

Optional wrong answer hint: None [RETURN]

Repeat Instructions [I] _____

or specify other:

_____ *

AUTHOR SHEET

Question

LESSON INDEX INFORMATION Q U _ _ _ _ _ _ _ _ _ _

Subject Area __ Category Number __ __ Level __

Author _____ School _____

Objective _____

LESSON CONTENT:

Instructions: _____

_____

*

ITEMS

( ) Question:

*

Answer(s) _____ or _____

( ) Question:

*

Answer(s) _____ or _____

( ) Question:

*

Answer(s) _____ or _____

( ) Question:

*

Answer(s) _____ or _____

( ) Question:

*

Answer(s) _____ or _____

( ) Question:

*

Answer(s) _____ or _____

( ) Question:

*

Answer(s) _____ or _____

( ) Question:

*

Answer(s) _____ or _____

Use another author sheet to enter up to 20 questions.

LESSON OPTIONS: Do you want to modify standard options [Y] or [N] ____

If YES:

Presentation order: [S] sequential or [R] random ___

Time out: If not standard, specify seconds ___

Correct answer reinforcers other than standard

1 _____

2 _____

3 _____

Stars: [N] or [Y] _____

Wrong answer response on first try other than standard:

_____

Wrong answer response on subsequent tries other than standard:

_____

Optional wrong answer hint: None [RETURN]

Repeat Instructions [I] _____

or specify other:

_____ *

AUTHOR SHEET

LESSON INDEX INFORMATION S P _ _ _ _ _ _ _ _ _

Subject Area __ Category Number __ __ Level __

Author _____ School _____

Objective _____

LESSON CONTENT:

Instructions: _____

_____

*

LESSON ITEMS

	CORRECT	INCORRECT		
1		1A	1B	1C
2		2A	2B	2C
3		3A	3B	3C
4		4A	4B	4C
5		5A	5B	5C
6		6A	6B	6C
7		7A	7B	7C
8		8A	8B	8C
9		9A	9B	9C
10		10A	10B	10C
11		11A	11B	11C
12		12A	12B	12C

Use another author sheet to enter up to 25 items.

LESSON OPTIONS: Do you want to modify standard options [Y] or [N] ____

If YES:

Presentation order: [S] sequential or [R] random ___

Time out: If not standard, specify seconds ___

Correct answer reinforcers other than standard

1 _____

2 _____

3 _____

Stars: [N] or [Y] _____

Wrong answer response on first try other than standard:

_____

Wrong answer response on subsequent tries other than standard:

_____

Optional wrong answer hint: None [RETURN]

Repeat Instructions [I] _____

or specify other:

_____ *

AUTHOR SHEET

LESSON INDEX INFORMATION T A _ _ _ _ _ _ _ _

Subject Area __ Category Number __ __ Level __

Author _____ School _____

Objective _____

LESSON CONTENT:

Model Options: Student answer: number [N] or word [W] ___

Number of distractors: [2] or [3] ___

Instructions: _____

TARGET ITEMS	DISTRACTOR ITEMS	
1	1	21
2	2	22
3	3	23
4	4	24
5	5	25
6	6	26
7	7	27
8	8	28
9	9	29
10	10	30
11	11	31
12	12	32
13	13	33
14	14	34
15	15	35
16	16	36
17	17	37
18	18	38
19	19	39
20	20	40

ON OPTIONS: Do you want to modify standard options [Y] or [N] ____

If YES:

Presentation order: [S] sequential or [R] random ___

Time out: If not standard, specify seconds ___

Correct answer reinforcers other than standard

1 _____

2 _____

3 _____

Stars: [N] or [Y] _____

Wrong answer response on first try other than standard:

_____

Wrong answer response on subsequent tries other than standard:

_____

Optional wrong answer hint: None [RETURN]

Repeat Instructions [I] _____

or specify other:

_____ *

APPENDIX B

Teacher, Student, and Principal Questionnaires

TOTALS - OCTOBER

PRE-ATTITUDE QUESTIONNAIRE FOR CAI TEACHERS

School Totals for 8 schools

Teacher (optional) 21

Date _____

Results — Circle your response(s):

1. What exposure have you had to the use of computers in the classroom prior to your contact with CAI at RMC?

90% (19) 1--No previous exposure

10% (2) 2--Some previous exposure

3--A great deal of exposure

2. How would you describe your initial reactions to the CAI project?

48% (10) 1--Highly favorable (enthusiastic, optimistic)

43% (9) 2--Somewhat favorable (supportive but cautious)

10% (2) 3--Neutral

4--Strongly opposed (negative, pessimistic)

3. How would you describe your current reactions to the CAI project:

90% (19) 1--Highly favorable

10% (2) 2--Somewhat favorable

3--Neutral

4--Strongly opposed

4. Please describe your general professional feelings about how the CAI project is working in your school.

66% (14) 1--Very satisfied

33% (7) 2--Somewhat satisfied

3--Very dissatisfied

4--Undecided

Results

5. Please describe your professional judgment of this CAI project as a method of teaching special education students.

71% (15) a. 1--Very useful
24% (5) 2--Somewhat useful
--- -- 3--Not useful at all
5% (1) 4--Undecided

81% (17) b. 1--Very promising
14% (3) 2--Somewhat promising
--- -- 3--Not promising at all
5% (1) 4--Undecided

6. Please describe your professional judgment about the approach of this CAI project where teachers develop and share curriculum materials and assign lessons to individual students.

86% (18) 1--Very effective
14% (3) 2--Somewhat effective
--- -- 3--Not effective at all
--- -- 4--Undecided

7. Which of the following factors probably contributed to any resistance or negative reactions to the project you may have had? Check those that apply.

5% (1) 1. __ Previous experience with computers.
-- -- 2. __ Poor communications; people were not informed about the project.
-- -- 3. __ Knowledge that the project is funded by the government.
48% (10) 4. __ Idea that project may be very time consuming.
14% (3) 5. __ Change in the teacher's role.
29% (6) 6. __ Increased record keeping.
14% (3) 7. __ Other (please specify).
19% (4) 8. __ No resistance was encountered.
9. __ Don't know.

Results

8. To what extent would you support the CAI project if asked about its merit?

81% (17) 1--Very much

10% (2) 2--Some support

3--Not at all

4--Undecided

10% - NR

9. Approximately how many hours per week do you spend on planning for CAI? Circle one of the responses:

10% (2) 1--Less than one hour

57% (12) 2--One to three hours

14% (3) 3--Three to five hours

10% (2) 4--More than five hours

10% NR or Other

10. Do you feel that working on the CAI project is a worthwhile use of your time?

81% (17) 1--Very worthwhile

14% (3) 2--Somewhat worthwhile

--- -- 3--Not worthwhile at all

--- -- 4--Undecided

5% NR

Additional comments: (please see attached list)

PRE-ATTITUDE QUESTIONNAIRE FOR CAI TEACHERS

ADDITIONAL COMMENTS

1. I hope to be able to spend more time--most of our prep time has been filled with meetings dealing with the kinds of situations that have to be set up at the beginning of the year. Since I wrote this, I have put more time in; more like 3-5 hours.

2. Most effective program--very useful--drills very appropriate--games great!!! Can't wait to see results from pre- and posttests. Still find time to work on programming hard to get. Really great, overall.

3. I believe CAI can be invaluable. It has already shown it's value and the posibilities are endless if teachers maintain control. It does require a lot of time initially and I hope we can be provided with the proper amount of time from CUSD to insure its success.

4. The fact that the CAI project seems to be so well organized at the RMC level has made it so beautifully workable at the school level. I am quite impressed with the professionalism of the RMC coordinators, and their accessibility.

5. The children really enjoy using the computer, and it is most helpful to keep them zeroed in on a task until completed. The record program will be perfect for parent conferences, and to help us provide proof for the individualized educational program we're to provide the special education child. Thanks for choosing us. Most helpful of all is that Carolyn came to school and patiently led us through the phases of each program, and is always at hand to answer questions. As the lessons continue to be prepared, we've been somewhat overwhelmed to keep track. It's been helpful to record the titles of lessons under categories on 6" x 8" cards to facilitate the assigning.

6. Too early for many of these items.

7. (Re: question 6) Having the teachers develop, share and assign materials very important--glad the project is designed this way. (Re: question 10) It's very worthwhile anyway, but would be most if we could keep the computers another year to use these beautiful 1,000 lessons we're designing. Workshop 1--E Systems Hardware; I don't really remember this topic. The workshops were a good beginning. I'm so glad Carolyn was available to us to clarify items and help us get started. Thanks, Carolyn!.

8. I have withheld total support for the project because of some conflicts we have between computer scheduling and regular classroom work.

9. I feel this is a very useful and promising project. As with any new project, it has some "bugs" that need to be worked out. But once these minor problems are worked out, the project will be fantastic. I am especially impressed by the very helpful and friendly RMC people. They have added a warm and human touch to the project.

10. There are a lot of needs for the children in my class that the computer does not meet, such as: Mary cannot see the printed question because it is so low on the typewriter. Some of the children cannot read. I believe that it will be more beneficial after some special alterations and additions have been made.

DECEMBER TOTALS

CAI INTERIM INSTRUCTIONAL STAFF EVALUATION FORM

School Name Totals for 8 schools

Teacher 21

Instructional Aide _____

1. Please indicate the student behavior you have observed thus far in the CAI Project. Use the following scale:

   1 very positive
   2 somewhat positive
   3 negative
   4 no basis for answer

	Change in student behavior - %				
	1	2	3	4	NR
a. Cooperation	53	38	10		
b. Self-control	33	52	10		5
c. Motivation	67	29			5
d. Attends to learning ta sk	67	19	10		5
e. Follows directions	19	57	10		5
f. Enthusiasm	57	38	5		

2. What aspects of the project have produced problems? Check all that apply.

48% a. __ Assigning lessons to students
10% b. __ Using the model programs to create lessons
10% c. __ Using the computer terminal
24% d. __ Record keeping
33% e. __ Student scheduling
38% f. __ Having appropriate reading materials
5% g. __ Having appropriate math materials
14% h. __ Having appropriate language arts materials
5% i. __ Using lesson directories
19% j. __ Others (specify)

3. Below is a list of areas in which you may have needed assistance from RMC in the operation CAI project. Using the following scale, please indicate the extent of assistance you have needed in each of these areas.

Extent: 1 a great deal
2 some
3 minimal

	Extent of Assistance			
	1	2	3	NR
a. Daily use of the CAI system	10	5	86	
b. Use of CAI equipment	20	38	52	
c. Use and interpretation of student CAI reports	5	24	66	5
d. Selection of lessons to suit individual students' needs	14	23	57	5
e. Creating lessons	10	29	57	5

4. What additions or revisions would you make to the CAI project (materials, hardware, etc.) to improve the instruction for students?

5. How useful for your students are the lessons created by other teachers? Use the following scale:

1 very useful
2 somewhat useful
3 not useful at all

	Usefulness of Lessons			
	1	2	3	NR
a. Reading	66	29	-3	5
b. Math	76	19	-3	5
c. Language Arts	62	19	14	5

6. Approximately what percent of the lessons you assign are created by yourself?

15% a. __ All
24% b. __ 75%
19% c. __ 50%
42% d. __ 25%
e. __ None
f. __ Other

7. Approximately how much time do you spend each week preparing lessons for the CAI project?

29% a. __ Less than one hour NR--
67% b. __ 1-3 hours
c. __ 3-5 hours
d. __ More than 5 hours
5% e. __ No Response

8. Do you feel that working on the CAI project is a worthwhile use of your time?

76% a. __Very worthwhile
24% b. __Somewhat worthwhile
c. __Not worthwhile at all
d. __Undecided

9. Additional comments: (please see attached list)

CAI INTERIM INSTRUCTIONAL STAFF EVALUATION FORM

ADDITIONAL COMMENTS

1. Appreciate support and friendly help from people involved at RMC. We have enjoyed being a part of this project and hope to use it next year.

2. Even though the novelty of the computer has worn off, I could tell today the students' enthusiasm is still high when the computer system was out of order and they couldn't have their lessons.

3. The computer has been the highlight at Grant this year. Children respond to the lessons on this, as I have not seen them respond in class: they are always willing to attend.

4. Overall positive response; would like to see assignment of lessons facilitated.

5. We've run into the problem of CAI taking valuable time out of the classroom (of our aides). We feel it is an excellent, worthwhile program, but does limit or retard our other programs. We'd like to see more staffing time available so that classroom work and programs do not suffer.

6. A super program--but we do have some internal program problems that if worked out properly should prove nothing more than its benefits to our special education programs.

7. This could be extremely worthwhile if time permitted. My problem is time. There just doesn't seem to ever be enough. We do need additional aides for this program not to become a hardship on the teachers' time!

8. The terminal and lessons have been a very useful tool for reinforcing skills learned in the centers. It has also helped them to be motivated in working to learn new skills.

POST-ATTITUDE QUESTIONNAIRE FOR CAI TEACHERS

School 8 schools

Teacher (optional) 18

Date May 1978

Circle your response(s):

1. How would you describe your current reactions to the CAI project:

78% 1--Highly favorable

17% 2--Somewhat favorable

05% 3--Neutral

4--Strongly opposed

2. Please describe your general professional feelings about how the CAI project is working in your school.

83% 1--Very satisfied

17% 2--Somewhat satisfied

3--Very dissatisfied

3. Please describe your professional judgment of this CAI project as a method of teaching special education students.

89% a. 1--Very useful

11% 2--Somewhat useful

3--Not useful at all

89% b. 1--Very promising

11% 2--Somewhat promising

3--Not promising at all

4. In your opinion, how much did the CAI project help improve the academic performance of your students.

44% 1--A great deal

44% 2--Somewhat

3--Not at all

12% No response

5. Please indicate the student behavior you have observed in the CAI Project. Use the following scale:

   1 Very positive

   2 Somewhat positive

   3 Negative

   4 No basis for answer

	1	2	3	4	NR
a. Cooperation	78	11			11
b. Self-control	44	50			6
c. Motivation	83	11			6
d. Attends to learning task	55	39			6
e. Follows directions	44	50			6
f. Enthusiasm	78	16			6

6. Please describe your professional judgment about the approach of this CAI project where teachers develop and share curriculum materials and assign lessons to individual students.

94% 1--Very effective

6% 2--Somewhat effective

3--Not effective at all

7. Did you, as a teacher, like having the control of the curriculum structure.

89% 1--Very much

11% 2--Somewhat

3--Not at all

8. Did you use CAI lessons to supplement your regular classroom lessons?

61% 1--Very much

39% 2--Somewhat

3--Not at all

9. Did the use of CAI allow you to individualize your instruction more effectively?

72% 1--Yes

28% 2--Somewhat

3--Not at all

10. Coordinating CAI with your classroom activities was:

33% 1--No problem, easily accomplished

33% 2--Accomplished with some effort

33% 3--Difficult

4--Never really accomplished because of other constraints

11. How useful for your students are the lessons created by other teachers?

Use the following scale:

33% 1--Very useful

45% 2--Somewhat useful

3--Not useful at all

22% No response

	Usefulness of Lessons			
	1	2	3	NR
a. Reading	67	22		11
b. Math	50	22	11	17
c. Language Arts	33	33	17	17

12. Approximately what pecent of the lessons you assign are created by yourself?

06% a. _____ All

22% b. _____ 75%

28% c. _____ 50%

44% d. _____ 25%

E. _____ None

13. Approximately how much time do you spend each week preparing lessons for the CAI project?

44% a. _____ Less than 1 hour

50% b. _____ 1-3 hours

c. _____ 3-5 hours

6% d. _____ More than 5 hours

14. Do you feel that working on the CAI project is a worthwhile use of your time?

83% a. _____ Very worthwhile

17% b. _____ Somewhat worthwhile

c. _____ Not worthwhile at all

15. Any additional comments on the affect or use of CAI for special education?

15. Comments:

I hope we will have the terminals for next year. My enthusiasm for this operation was dampered by the fact that it was only for one year. I/wouldn't mind creating new programs if we could have use of the terminals for the coming years.

I certainly hope our district will purchase the material. The students were enthusiastic about using the computer thoughout the entire year. It saved me time, as the computer was like another teacher who came in and worked with the student. Whenever the computer was not working, I had to work harder. It definitely brightened the special ed. student's day to be able to use the computer either for lessons or games.

CAI has proved very effective in motivating students to work. It has also reinforced materials presented by the teacher as well as helped in identifying student weaknesses for further teaching.

It fits in beautifully with the special ed. program. It probably was the single most motivation I had this year. It always seemed to be such a positive inducement. There definitely must be a way to continue.

In an area such as Santa Clara where computers play such an important part in the economy, CAI offers special ed. students one way to overcome obstacles. It would be more than slightly ludicrous not to maintain the program at CUSD.

Hope we can have it again next year.

Special education at our school is a very structured program run very much like regular classes with lesson presentation, discussion, in-class work, etc. We found it very hard to pull kids out of this kind of class and have them work on the computer. The program, therefore, became an occasional supplement rather than a daily form of learning.

It has been an exciting project to participate in. The students loved it. It was great for reinforcement of concepts. Hope it continues in some mode next year. Have appreciated the cooperation of the RMC staff.

The lessons are specific and short. The special ed. child can attend well for a short period of time. The varied lessons offer the chance for the child to review many areas in a week's lesson.

Would very much like to see project continue.

I found CAI to be very effective for drill exercises in math, which is the only subject I teach in the center. I massed drill in the beginning of the year until Christmas break and I have had the students reviewing on a more individual basis since then in hopes of increasing mastery and retention.

If I had additional help to sit with my less ability students, the computer would be more effective.

Barbara Paape
Specialist Teacher
Eaton School
5/11/78

COMMENTS ON THE CAI PILOT PROJECT

I appreciate the opportunity to be involved in the CAI pilot project. The computer not only helped the students learn important skills, but increased their ability to work independently. The older students became very responsible, helping keep track of their time, recording their own scores, etc. Motivation for the computer may be down a bit now due to continued use and "Spring Fever," but each child, I'm sure, will miss it when it's gone.

The program for learning handicapped students at our school is an excellent one, involving careful diagnosis and individualized plans for each child, including motor skills, visual and auditory perceptual skills, reading, math, spelling and peer counseling groups. Because of this program, students made good progress last year, before the arrival of the computer, and will continue to make good progress after the computer leaves. If our overall program had not been so balanced and effective, I believe the effect of the CAI project on the academic performance of the students would have been felt even more. CAI became one more worthwhile, motivating, effective teaching tool we used among others.

The fact that teachers were able to develop and share curriculum materials and have control of the curriculum structure was important for the success of the CAI program. I was able to say to a child, "Remember how hard it was for you to say the "n" in the middle of the word, "pink?" Here's a special lesson I made to help you. Or, for another child, "You're working hard to learn the difference between "even" and "odd" numbers. These lessons will help you."

In all systems there are lessons that don't work. In this CAI project a teacher could revise a lesson, if his/her own, to make it work, or create a new lesson to fill a gap, or better suit the needs of a particular child.

PENPAL notes became an easy and very motivating way to communicate with one child daily and to give him more reason for getting to school. Another teacher had her students "publish" their own stories through use of NARRATIVE.

It became easy for teachers to move into the world of selecting, creating, revising lessons and using programs like PENPAL and NARRATIVE due to different models provided for us, the inservice meetings, and most important, the weekly backup of Carolyn, who answered our questions, encouraged us and helped us develop our ideas and adapt them for the computer.

CAI is worthwhile for Learning Handicapped students. As one of our cross-age tutors said," The computer is real neat. I hope they have it next year. The kids like it a lot and it's very educational."

RMC-CAI Student Questionnaire
To be Completed at Time of Post Testing

School 8 schools
Name 113
Date May 1978
Tester Initial _____

1. _____ (child's name), I hear you've been working on the computer in your classroom. Did you like it?

85% yes 05% no 10% don't know (shrug)

2. What did you like best about the computer?

Games/pictures, 39%; lessons, 08%; math, 05%; spelling, 04%; typing, 02%; everything, 05%; no response, 16%; see additional comments

3. Do you think the computer lessons helped you?

84% yes 10% no 06% don't know (shrug)

4. Were the lessons too easy, too hard, or just right for you?

38% too easy 12% too hard 61% just right 12% NR

5. Was it:

	Yes	No	Don't Know	NR
fun	93%	03%	03%	1
waste of time	09%	84%	06%	1
boring	17%	75%	07%	1
neat	75%	03%	03%	19%
other (said)				
no response: 19%				

6. Would you like the computer to stay in (or near) your classroom?

88% yes 03% no 09% don't know (shrug)

7. The people who put the computer in your classroom are interested in how you feel about the computer lessons. Is there anything special you would like to tell them?

No 81%

Comments 19%

2. Additional Comments to "What did you like best about the computer?"

Liked the way they worked
The way they teach you
Fun to do
Exact
Says a lot of neat stuff
Like a human
It talks to you
Makes it easy to study
I like how it talks back
I like when it's my turn
The sign-off messages
It's friendly
Asks questions about me
The counting questions
It's friendly
The good-try again part, computer talk
I could change if I was bored
Can't beat you up
When it gives you a second chance

7. The people who put the computer in your classroom are interested in how you feel about the computer lessons. Is there anything special you would like to tell them?

Make more games, like history stuff
Good program
Tell them not to let the machines break down
It's really good, trys to help people
Didn't teach me much. Computer goofed up all the time
Liked them
Make it so we can type reports
Pretty neat
It was slow, sometimes
Sometimes your computer was wrong
Thanks
It helped me
Fun
Good
I liked the way it types
Like to finish so I have time for another lesson
Hmm, I just liked it
More games, like Star Trek
Whole school should have them
It really helps you
Sometimes it was slow
How does it know my name?

RMC-CAI Principal Questionnaire

School _____
Name _____
Date _____

Circle your response(s):

1. What is your opinion of the CAI project for special education in your school?

87% 1--Highly favorable
13% 2--Somewhat favorable
3--Neutral
4--Strongly opposed

2. Do you think the CAI project has been a useful supplement for special education?

87% 1--Very useful
13% 2--Somewhat
3--Not effective
4--No basis for judgement

3. Do you think the the special education students have benefitted from the CAI instruction?

87% 1--A great deal
13% 2--Somewhat
3--Not effective
4--No basis for judgement

4. Have you heard favorable comments about the CAI project in your school from:

	a great deal	moderate amount	none	NR
a. teachers in the project	87%	13%		
b. students in the project	75%	12%		12%
c. parents of students in project	25%	37%	13%	25%
d. other students	25%	25%	25%	25%
e. other teachers	12%	12%	38%	38%

5. If this CAI project were available to your school in the future, what do you think would be a reasonable amount to spend on the project per pupil, per year?

13% a. $500.00
13% b. $200.00
37% c. $100.00
d. $ 50.00
e. none
12% any amount 1
25% NR

6. Additional comments would be appreciated on back.

END

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